

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

UNITED STATES DEPARTMENT OF AGRICULTURE



DEPARTMENT BULLETIN No. 1314



Washington, D. C.

February 17, 1925

A BIBLIOGRAPHY RELATING TO SOIL ALKALIES

Compiled with Special Reference to the Deleterious Action of Soil Alkalies, and Various Other Chemical Agents on Cement and Concrete

Compiled under the direction of

SAMUEL H. McCORRY, *Chief, Division of Agricultural Engineering*

By FOREST V. KING, *Drainage Engineer*, GUY ERVIN, *Assistant Irrigation Engineer*, and O. LOUISE EVANS, *Assistant Librarian, Bureau of Public Roads*

CONTENTS

	Page		Page
Word and phrase abbreviations.....	1	IV. Other injurious agents.....	27
Abbreviations for names of periodicals cited...	2	Effects of sewage, acids, oils and various chemicals on mortar and concrete; measures for prevention.	
I. Soil alkalinity.....	6	V. Waterproofing of concrete.....	34
Origin, distribution, physical, and chemical properties, and treatment.		Various methods and the effects of their use.	
II. Alkali soils salts.....	11	VI. Alkali-resistant concrete.....	38
Effects on mortar and concrete and measures for prevention.		Special ingredients and methods for producing resistance to alkali and seawater; incidental effects of same.	
III. Sea water.....	18		
Effects on mortar and concrete and measures for prevention; sea water structures of concrete.			

WORD AND PHRASE ABBREVIATIONS

Abs.....	Abstract.	Jour.....	Journal.
Ag.....	Agriculture.	Min.....	Minutes.
An.....	Annual.	Munic.....	Municipal.
Ass'n.....	Association.	Proc.....	Proceedings.
Bd.....	Board.	Pt.....	Port.
Bul.....	Bulletin.	Rpt.....	Report.
Col.....	Column.	Sect.....	Section.
Concl.....	Conclusions.	Ser.....	Series.
Disc.....	Discussions.	Soc.....	Society.
Ed. Comment.....	Editorial Comment.	Suppl.....	Supplement.
Eng.....	Engineer, Engineering.	Tech.....	Technical.
Exten. Abs.....	Extensive Abstract.	Trans.....	Transactions.
Exc.....	Excerpts.	U. S. D. A.....	U. S. Department of Agriculture.
Inst.....	Institute.	U. S. G. S.....	U. S. Geological Survey.
Int.....	International.		

ABBREVIATIONS FOR NAMES OF PERIODICALS CITED

Am. Cer. Soc. Trans.....	American Ceramic Society. Transactions.
Am. Chem. Soc. Jour.....	American Chemical Society. Journal.
Am. Contr.....	American Contractor.
Am. Port Auth. Proc. & Papers.....	American Port Authorities, Proceedings and Papers.
Ann. des. P. et Chs.....	Annales des Ponts et Chaussées.
A. P. C. M. Bul.....	Association of American Portland Cement Manufacturers. Bulletin.
A. P. C. M. Min.....	Association of American Portland Cement Manufacturers. Minutes.
A. Ry. E. A. Bul.....	American Railway Engineering Association. Bulletin.
A. Ry. E. A. Proc.....	American Railway Engineering Association. Proceedings.
A. Ry. E. & M. W. A. Bul.....	American Railway Engineering and Maintenance of Way Association. Bulletin.
A. S. C. E. Proc.....	American Society of Civil Engineers. Proceedings.
A. S. C. E. Trans.....	American Society of Civil Engineers. Transactions.
A. S. M. E. Jour.....	American Society of Mechanical Engineers Journal.
A. S. T. M. Proc.....	American Society for Testing Materials. Proceedings.
A. W. W. A. Proc.....	American Water Works Association. Proceedings.
Ariz. Sta. Bul.....	Arizona Agricultural Experiment Station Bulletin.
Balt. Eng. Club Jour.....	Baltimore Engineering Club Journal.
Bet. u. Eis.....	Beton und Eisen.
Calif. Sta. Bul.....	California Agricultural Station. Bulletin.
Calif. Sta. Rpt.....	California Agricultural Station. Report.
Can. Cem. & Conc. Rev.....	Canadian Cement and Concrete Review.
Can. Eng.....	Canadian Engineer.
Can. Eng. Inst. Jour.....	Canadian Engineering Institute. Journal.
Cement.....	Cement.
Cem. Age.....	Cement Age.
Cem. & Eng. N.....	Cement and Engineering News.
Cem. Era.....	Cement Era.
Chem. Abs.....	Chemical Abstracts.
Chem. Eng.....	Chemical Engineer.
Chem. & Met. Eng.....	Chemical and Metallurgical Engineering (Met. and Chem. Eng. up to 1918).
Chem.-Zeit.....	Chemiker-Zeitung.
Ciment.....	Ciment.
Colo. Sta. Bul.....	Colorado Agricultural Experiment Station. Bulletin.
Concrete.....	Concrete.
Conc. Cem. Age.....	Concrete-Cement Age.
Conc. & Const. Eng.....	Concrete and Constructional Engineering.
Conc. Eng.....	Concrete Engineering.
Contract Rec.....	Contract Record.
Dinglers Polytech. Jour.....	Dinglers Polytechnisches Journal.
Dom. Eng.....	Domestic Engineering.
Engineer.....	Engineer.
Engineering.....	Engineering.
Eng. & Contr.....	Engineering and Contracting.
Eng. Mag.....	Engineering Magazine.
Eng. N.....	Engineering News.
Eng. N. Rec.....	Engineering News Record.
Eng. Rec.....	Engineering Record.
Exper. Sta. Rec.....	Experiment Station Record (U. S. D. A.).
Franklin Inst. Jour.....	Franklin Institute. Journal.
Gesundheits-Ingenieur.....	Gesundheits-Ingenieur.
Harvard Eng. Jour.....	Harvard Engineers Journal.

Iowa Sta. Bul.....	Iowa Agricultural Experiment Station. Bulletin.
Idaho Eng. Soc. Jour.....	Idaho Engineers Society. Journal.
Idaho Sta. Bul.....	Idaho Agricultural Experiment Station. Bulletin.
Inst. Civil Eng. (Lond.) Min. & Proc.	Institution of Civil Engineers, London. Minutes and proceedings.
Int. A. T. M. Proc.....	International Association for Testing Materials. Proceedings.
Off Rpts.....	Official reports.
Non. Off. Papers.....	Nonofficial papers.
Int. Eng. Cong. Trans.....	International Engineering Congress. Transactions.
Int. Marine Eng.....	International Marine Engineering. (Now Marine Engineering and Shipping Age.)
Jour. Ag. Research.....	Journal of Agricultural Research (U. S. D. A.).
Jour. Ind. & Eng. Chem.....	Journal of Industrial and Engineering Chemistry.
Lond. Chem. Soc. Jour.....	London Chemical Society. Journal.
Met. & Chem. Eng.....	Metallurgical and Chemical Engineering. (Chem. & Met. Eng. after 1918.)
Mich. Sta. Bul.....	Michigan Agricultural Experiment Station. Bulletin.
Mitt. Kgl. Matpr.....	Mitteilungen aus dem Koniglichen Materialprüfungsamt zu Berlin-Lichterfelde-West.
Mont. Sta. Bul.....	Montana Agricultural Experiment Station. Bulletin.
Munic. Eng.....	Municipal Engineering.
N. A. Cem. Users Proc.....	National Association of Cement Users. Proceedings.
N. Mex. Sta. Bul.....	New Mexico Agricultural Experiment Station. Bulletin.
N. Y. (city) Pub. Imp. Div. Rpt.	New York (City) Board of Estimates and Appropriations. Division of Public Improvements. Report.
N. Y. (city) Water Supply Bd. An. Rpt.	New York (City) Board of Water Supply Annual Report.
Ohio Sta. M. Bul.....	Ohio Agricultural Experiment Station Monthly Bulletin.
Philippine Jour. Sci.....	Philippine Journal of Science.
Portland Cem. Ass'n Min.....	Portland Cement Association. Minutes.
Prof. Mem.....	Professional Memoirs. (United States Army.)
Pub. Rds.....	Public Roads.
Pub. Wks.....	Public Works.
Rel. Rec.....	Reclamation Record.
Russ. Jour. Exper. Landw.....	Russisches Journal fur Experimentelle Landwirtschaft. (Zhurnal Opuitnoi Agronomia.)
Ry. Age Gaz.....	Railway Age Gazette.
Ry. Eng.....	Railway Engineer.
St. Louis Eng. Club Jour.....	Engineers Club of St. Louis (Mo.). Journal.
Sci. Am.....	Scientific American.
Sci. Am. M.....	Scientific American Monthly.
Sci. Am. S.....	Scientific American Supplement.
Soc. Chem. Ind. Jour.....	Society of Chemical Industries. Journal.
Soc. d'Encour. l'Ind. Nat. Bul.....	Societe d'Encouragement pour l'Industrie Nationale. Bulletin.
Stadt. Tiefb.....	Der Stadtische Tiefbau.
Surveyor.....	Surveyor and Municipal and County Engineer.
Ton. Zeit.....	Tonindustrie-Zeitung.
U. S. Bur. Soils Bul.....	United States Department of Agriculture. Bureau of Soils. Bulletin.
U. S. Bur. Stand. Tech. Paper.....	United States Department of Commerce. Bureau of Standards. Technologic paper.
U. S. D. A. Bul.....	United States Department of Agriculture. Bulletin.
U. S. G. S. Bul.....	United States Department of Interior. Geological Survey. Bulletin.
Utah Sta. Bul.....	Utah Agricultural Experiment Station. Bulletin.

W. Soc. Eng. Jour.....	Western Society of Engineers. Journal.
Was. u. Abw.....	Wasser und Abwasser.
Waterpf. & Firepf.....	Waterproofing and Fireproofing.
Wis. Eng.....	Wisconsin Engineer.
Wis. Sta. Bul.....	Wisconsin Agricultural Experiment Station. Bulletin.
Wyo. Sta. Bul.....	Wyoming Agricultural Experiment Station. Bulletin.
Zeit. Ang. Chem.....	Zeitschrift fur Angewandte Chemie.

The references contained in this bulletin were compiled in connection with an investigation by the Bureau of Public Roads of the effect of soil alkalies on concrete drain tile. The bibliography is believed to be fairly complete in respect to articles published prior to 1924. The importance of the problem presented by the use of concrete structures in sea water and in soils containing various acids and alkalies has long been recognized. To one engaged in the study of any phase of the problem the literature extant is indispensable. Such a compilation necessarily requires considerable time and labor, and in order that the results of this search may be made accessible to as many as possible the bibliography is published as a bulletin.

EXPLANATORY NOTES

The references are arranged alphabetically by authors under each of the six headings. Each article is placed under the heading which most nearly describes its main content and those which fall under more than one heading are cross-indexed. The Roman numerals used in connection with authors' names indicate the headings under which the cross-indexed references appear. Plural authorship is cross-indexed in a like manner. At the end of the groups are lists of references, arranged alphabetically by titles, referring to articles the authorship of which is not indicated. These are also cross-indexed by Roman numerals. The abstract in each case refers to the first reference given under the title. The other references under a given title may or may not be of the same title, but are concerned with the same subject matter. Inclusive paging is not always given for these supplementary references.

I. SOIL ALKALINITY

ORIGIN, DISTRIBUTION, PHYSICAL AND CHEMICAL PROPERTIES AND TREATMENT

- ALADJEM, R. *Decomposition of Nitrates as a Possible Cause of Formation of Sodium Carbonates in Egyptian Soils*. Cairo Scientific Jour., v. 6 (1912), p. 301-302.
Outline of tests to determine effect of continuous water-logged condition upon nitrification of soils.
- AMES, J. W. *Some Alkali Soils in Ohio*. Ohio Sta. M. Bul. 1 (1916), p. 209-210.
Nontechnical discussion.
- BANCROFT, R. L. *Alkali Soils of Iowa*. Iowa Sta. Bul. 177 (1918), 22 p.
A study of conditions and methods for correction. Diagrammatic and tabular data.
- BEESON, J. L. *Physical Effects of Various Salts and Fertilizer Ingredients Upon a Soil as Modifying the Factors Which Control Its Supply of Moisture*. Am. Chem. Soc. Jour., v. 19 (1897), p. 620-649.
Experiments on rate of saturation, percolation, capillary rise, and evaporation as affected by salts. Tabular data.
- BERGE, R. *Emploi de la Chaux et des Craies Broyees Pour Corriger L'Acidite des Sols*. Academie d'agriculture (France), Comptes Rendus, v. 6 (1920), p. 934-9.
- BREAZEALE, J. F. *Formation of Black Alkali (Sodium Carbonate) in Calcareous Soils*. Jour. Ag. Research, v. 10 (1917), p. 541-589.
Extended technical discussion of formation of black alkali from sodium salts and calcium carbonate and retarding effects of various other salts. Action of black alkali on soil and vegetation. Results of laboratory tests. Much tabular data. Bibliography.
- BRIGGS, L. J. *Electrical Instruments for Determining the Moisture, Temperature, and Soluble Salt Content for Soils*. U. S. Bur. Soils Bul. 15 (1899), 35 p.
Detailed description of electric hygrometer, electric soil thermometer, and electrolytic soil bridge, their use and adjustments. Diagrammatic and tabular data. Illustrated.
- BRIGGS, L. J. and M. W. LAPHAM. *Influence of Dissolved Salts on the Capillary Rise of Soil Waters*. U. S. Bur. Soils Bul. 19 (1902), p. 5-18.
Laboratory tests on soil from James Island, S. C. Tabular data and drawings.
- BROWASH, A. H. See SHUTT, F. T., and A. H. BROWASH, I.
- BROWN, O. F., and R. A. HART. *Reclamation of Seeped and Alkali Lands*. Utah Sta. Bul. 111 (1910), p. 75-92.
Recommendations concerning drainage and subsequent treatment of alkali lands. Diagrams. Illustrated.
- BROWN, P. E. See STEVENSON, W. H., and P. E. BROWN, I.
- BURD, J. S. *Alkali and the Treatment of Alkali Lands (I and II)*. Idaho Sta. Bul. 44 (1904) and 51 (1905), 10 p. and 20 p.
Discusses origin, nature, effects of alkali in soil and water. Drainage as a reclamation measure. Tabular data.
- BUTT, N. I. See HARRIS, F. S., and N. I. BUTT.
- CAMERON, F. K. *Alkali*. "The Soil Solution" (Easton, Pa., 1911), p. 110-125.
General discussion of the origin and distribution of alkali. Drainage as a reclamation measure. Tabular data.
- *Formation of Sodium Carbonate, or Black Alkali, by Plants*. U. S. D. A. Rpt. 71 (1902), p. 61-70.
General discussion. Considers specific plants. Tabular data.
- and H. E. PATTEN. *Removal of Black Alkali by Leaching*. Amer. Chem. Soc. Jour., v. 28 (1906), p. 1639-1649.
Investigations and conclusions as to methods and success of such reclamation. Tabular data.
- CLARKE, F. W. *Data of Geochemistry*. U. S. G. S. Bul. 695 (1920), 832 p. *Ibid.*, Bul. 616 (1916), 821 p.
A critical summary of existing knowledge and guide to important literature on the subject.
- COLE, L. H. *Alkali Deposits of Western Canada*. Can. Eng., v. 40 (1921), p. 460.
Discusses nature and distribution of alkali salts in waters and soils.
- CRAWLY, J. T. *Water-Holding Power and Irrigation of Hawaiian Soils. The Application of Nitrate of Soda. The Accumulation of Salt in Hawaiian Soils*. Hawaiian Planters, v. 21 (1902), p. 358-63. Abs., Exper. Sta. Rec., v. 14, p. 555.
Discusses irrigation, fertilization, and salt concentrations in Hawaiian sugar lands. Tabular data.
- DEAKIN, A. *Irrigated India*. (London, 1893), 322 p.
Narrative account of India: Its people, their activities, and in particular, the irrigation systems.
- DIMO, N. A. *Influence of Irrigation and of Increased Natural Humidity on the Process of Soil Formation and of the Transportation of Salts in the Soils and Subsoils of the Golodnoi (Hungary) Steppe*. Russ. Jour. Exper. Landw., v. 15 (1914), p. 136-138. Abs., Exper. Sta. Rec., v. 34, p. 16.
A study of the compositions of soils and waters.

DORSEY, C. W. *Alkali Soils of the United States*. U. S. Bur. Soils Bul. 35 (1906), 196 p.

Review of literature and summary of information to date on origin, nature, distribution, and treatment of soil alkali. Maps and tabular data.

— *Reclamation of Alkali Land in Salt Lake Valley, Utah*. U. S. Bur. Soils Bul. 43 (1907), 28 p.

Describes alkali conditions and methods of reclamation. Tabular data. Illustrated.

— *Reclamation of Alkali Soils*. U. S. Bur. Soils Bul. 34 (1906), 30 p.

Origin, accumulation, and effects of soil alkali. Prevention of accumulation, and physical and chemical methods of reclamation. Illustrated.

— *Reclamation of Alkali Soils at Billings, Montana*. U. S. Bur. Soils Bul. 44 (1907), 21 p.

Describes alkali conditions and methods of reclamation.

FORBES, R. H. *River Irrigating Waters of Arizona—Their Character and Effects*. Ariz. Sta. Bul. 44 (1902), 68 p.

Study of contents and value of irrigating waters. Diagrammatic and tabular data. Illustrated.

GARDNER, F. D., and J. STEWART. *Soil Survey in Salt Lake Valley, Utah*. U. S. D. A. Rpt. 64 (1899), p. 77-113.

Reports investigation of soil and waters with respect to alkali conditions. Diagrammatic and tabular data. Illustrated.

GAUDECHON, H. See MUNTZ, A., and H. GAUDECHON, I.

GEDROITS, K. K. *Colloidal Chemistry in the Soils*. Russ. Jour. Exper. Landw. 13 (1912), p. 363-420. Abs., Exper. Sta. Rec., v. 28, p. 516.

Study of colloidal substances and soluble salts in soils.

GREAVES, J. E. See STEWART, R., and J. E. GREAVES, I.

GREAVES, J. E., and C. T. HIRST. *Composition of the Irrigation Waters of Utah*. Utah Sta. Bul. 163 (1918), 43 p.

A study of salts found in waters of Utah with suggestions as to irrigation methods. Diagrams and tabular data. Illustrated.

HARRIS, F. S. *Movement of Soluble Salts with the Soil Moisture*. Utah Sta. Bul. 139 (1915), p. 119-124.

Discusses alkali accumulations as due to movement of salts in solution; evils of over-irrigation. Tabular data. Diagrams.

— *Soil Alkali*. (New York and London, 1920), 246 p.

General treatise on origin, distribution, effects and treatment of alkali soils. Discusses physical, chemical and biological aspects, reclamation and cropping. Tabular data. Illustrated.

HARRIS, F. S., and N. I. BUTT. *Effect of Irrigation Water and Manure on the Nitrates and Total Soluble Salts*

of the Soils. Jour. Ag. Research, v. 8 (1917), p. 333-359.

Experimental investigations in Utah and deductions. Bibliography. Diagrams and tables.

HARRIS, F. S., and J. S. ROBINSON. *Factors Affecting the Evaporation of Moisture from the Soil*. Jour. Ag. Research, v. 7 (1916), p. 439-461.

Experimental investigations and results, with bibliography. Tables and diagrams.

HART, R. A. *Drainage of Irrigated Farms*. U. S. D. A., Farmers' Bul. 805 (1917), 31 p.

Discusses need and benefits of draining irrigated lands. Describes methods of design and installation.

— *Drainage of Irrigated Land*. U. S. D. A. Bul. 190 (1915), 34 p.

Discusses need, methods, design, construction, maintenance and cost.

See also BROWN, C. F., and R. A. HART, I.

HEADDEN, W. P. *Alkalies in Colorado (including nitrates)*. Colo. Sta. Bul. 239 (1918), 58 p.

Formation, nature, effects, and differences of "white" and "black" alkalies and nitrates.

— *"Black Alkali" in the San Luis Valley*. Colo. Sta. Bul. 231 (1917), 15 p.

Discusses effects on agriculture of detrimental amounts of "black alkali" in San Luis Valley, Colo. Suggests gypsum treatment of soil as remedy.

— *Colorado Irrigation Waters and Their Changes*. Colo. Sta. Bul. 82 (1903), 77 p.

Extensive investigations and analyses of ground and surface waters. Much tabular data.

— *Fixation of Nitrogen*. Colo. Sta. Buls. 155 (1910), 48 p.; 178 (1911), 96 p.; and 186 (1913), 47 p.

Discusses the formation, nature and effects of nitre, often mistaken for "black alkali."

— *Soil Study, III. The Soil*. Colo. Sta. Bul. 65 (1901), 55 p.

Colorado soil study. Special reference to soluble salts.

— *Soil Study, IV. The Ground Water*. Colo. Sta. Bul. 72 (1902), 47 p.

Physical and chemical aspects of ground water in Colorado. Alkali effects discussed. Tabular data.

HILGARD, E. W. *Lakes of the San Joaquin Valley*. Calif. Sta. Bul. 82 (1889), 4 p.

Study of salt content.

— *Quality of Irrigation Water*. Soils. (New York, 1911), p. 246-253.

Discusses allowable concentration of soluble salts and precautions in use for irrigation. Concerns effects on vegetation only.

— *Soils*. (New York, 1911), 593 p.

General treatise on soils; their origin, nature, properties and relations to physical laws and life.

See also SNOW, F. J., HILGARD, E. W., and G. W. SHAW, I.

- HILGARD, E. W. and R. H. LOUGHRIDGE, *Distribution of Salts in Alkali Soils*. Calif. Sta. Rpt. (1894-95), p. 37-72.
Discusses nature, formation, transportation, and effects of various alkali salts in soils and waters as affected by natural forces, and agricultural methods. Many diagrams and tables. Results of field investigations.
- HILGARD, E. W., and others. *Alkali and Alkali Soils*. Calif. Sta. Rpt., (1893-94), p. 140-156.
A study of California soils as to kinds and concentration of salts. Reclamation by gypsum discussed. Tabular data. Illustrated.
- HILL, E. G. *Analysis of Reh, the Alkali Salts in Indian Usar Land*. Lond. Chem. Soc. Proc., v. 19 (1903), p. 58-60. Abs., Exper. Sta. Rec., v. 14, p. 1056.
Describes chemical analyses. Tabular results.
- HIRST, C. T. See GREAVES, J. E., and C. T. HIRST, I.
- HISSINK, D. J. *Influence of Various Salt Solutions on the Permeability of Soils*. Chemisch Weekblad, v. 4 (1907), p. 663-670. Abs., Chemisches Zentralblatt (1907), II, No. 26, p. 2071. Abs., Lond. Chem. Soc. Jour., v. 92 (1907), part 2, p. 984. Abs., Exper. Sta. Rec., v. 20, p. 16.
Results of laboratory experiments with various solutions.
- KING, F. H. *Investigations in Soil Management*. (Madison, Wis., 1904), 168 p.
Discussion and conclusions of investigation of (1) Effects of manure soil dressing on crop yield and soluble salt content; (2) Movements of soluble salts in soils; and (3) Absorption of soluble salts by soil types. Tabular and diagrammatic data. Illustrated.
- . *Principles and Conditions of the Movements of Ground Water*. U. S. G. S. 19th An. Rpt. (1897-98), part 2, p. 59-286.
Discussion of ground-water movement in its various physical aspects with results and conclusions of extensive laboratory and field experimental investigations. Diagrammatic and tabular data. Illustrated.
- KNIGHT, W. C., and E. C. SLOSSON. *Alkali*. Wyo. Sta. Bul. 49 (1901), p. 75-79.
Short discussion of sources and nature of various salts.
- KOLOTOV, G. I. *Movement of Salts in Semi-arid Soils*. Russ. Jour. Exper. Landw., v. 12 (1911), p. 832-833. Abs., Exper. Sta. Rec., v. 28, p. 421.
Examination discussed.
- KOSSOVICH, P. See TULAYKOV, N., and P. KOSSOVICH, I.
- KOSSOVITCH, P. S. *Water-raising Capacity of Soils*. Russ. Jour. Exper. Landw., v. 11 (1910), p. 734.
- KRAVKOV, S. *On the Movement of Water and Salt Solutions in Soils*. Journal für Landwirtschaft, v. 48 (1900), p. 209-222. Abs. Exper. Sta. Rec., v. 12, p. 620.
Laboratory experiments determine movement as affected by various conditions.
- LAPHAM, M. W. See BRIGGS, L. J., and M. W. LAPHAM, I.
- LEATHER, J. W. *Investigations on Usan [Alkali] Land in the United Provinces*. Allahabad, India, Govt. (1914), 88 p. Abs., Exper. Sta. Rec., v. 33, p. 419.
An investigation of soil and waters with respect to origin, accumulations and movement of alkali salts. Conclusions regarding effects of irrigation and methods of reclamation. Tabular and diagrammatic data. Illustrated.
- LIPMAN, C. B. *New Experiments on Alkali Soil Treatment*. Univ. Calif. Publications in Agricultural Sciences, v. 1 (1915), p. 275-282.
Preliminary report on laboratory experiments with various chemical treatments. Tabular data. Illustrated.
- LOUGHRIDGE, R. H. See HILGARD, E. W., and R. H. LOUGHRIDGE, I.
- LOUGHRIDGE, R. H., and C. H. SHINN. *Reclamation Tests with Gypsum in Alkali Soils*. Calif. Sta. Rpt. (1891-92), Part 1, p. 80-90.
Describes experiments at Tulare Station. Tabular data.
- MACKIE, W. W. *Reclamation of White-ash Lands Affected with Alkali at Fresno, Calif.* U. S. Bur. Soils Bul. 42 (1907), 47 p.
Reclamation of hard-pan lands. Tabular data. Illustrated.
- MANN, H. H., and V. A. TAMHANE. *Salt Lands of the Nira Valley (India)*. Bombay Presidency, Dept. Ag. Bul. 39 (1910), 35 p.
Discusses source, distribution, kinds and concentration of salts, the cropping and reclamation of the lands. Special reference to drainage. Tabular data.
- MCCOOL, M. M., and C. E. MILLAR. *Soluble Salt Content of Soils and Some Factors Affecting It*. Mich. Sta. Tech. Bul. 43 (1918), 47 p.
Occurrence and movement of soluble salts as affected by natural forces. Diagrammatic and tabular data.
- MCOWEN, P. *Brak Land in Relation to Irrigation and Drainage*. Agricultural Journal (Cape of Good Hope) v. 22 (1903), p. 573-81.
Discusses alkali lands of South Africa and chemical treatment, drainage and reduction of evaporation as corrective measures. Tabular data.
- MEANS, T. H. *Rapid Method for the Determination of the Amount of Soluble Mineral Matter in a Soil*. Am. Jour. of Sci., v. 7 (1899), p. 264-266.
Description of electrical soil bridge and its use.
- . *Reclamation of Alkali Lands in Egypt*. U. S. Bur. Soils Bul. 21 (1903), 48 p.
Rather detailed description of Egyptian reclamation work as adapted to similar work in United States of America. Tabular and diagrammatic data. Illustrated.
- See also WHITNEY, M., and T. H. MEANS, I.

- MILLAR, C. E. See MCCOOL, M. M., and C. E. MILLAR, I.
- MILLER, D. G. *Seepage and Alkali Problem in the Grand Valley, Colo.* U. S. Bur. of Public Roads, mimeographed report, March, 1916.
This report deals with the practical phases of the problem of reclaiming lands that have become nonproductive due to alkali.
- MUNTZ, A., and H. GAUDECHON. *Diffusion of Fertilizer in the Soil.* Annales de l'Institute National Agronomique (Paris), 2 Ser. 7 (1908), p. 205-238. Comptes Rendus des Academie Science (Paris), v. 148 (1909), No. 5, p. 253-258. Abs., Exper. Sta. Rec., v. 21, p. 23. Abs., Lond. Chem. Soc. Jour., v. 96 (1909), No. 557, II, p. 259. Abs., Chem. Abs., v. 3 (1909), p. 1197.
Observations of diffusion under various conditions described. Conclusions and diagrammatic and tabular data. Illustrated.
- NOYES, H. A. *Soil Acidity, the Resultant of Chemical Phenomena.* Jour. Ind. and Eng. Chem., v. 11 (1919), p. 1040-1049.
Describes laboratory experiments on cause of soil acidity. Considerable technical detail. Tabular and diagrammatic data.
- O'BRIEN, D. *Alkali Soils of Colorado.* Colo. Sta. Bul. No. 9 (1889), 12 p.
Discusses nature and effects of salts and reclamation by drainage.
- PAGNOUL, A. *Moisture and Absorptive Power of Soils.* Terres Arables du Pas-de-Calais, Arras (1894), p. 128. Ex. Abs., Exper. Sta. Rec., v. 6 (1894), p. 118.
Part of a detailed report on the investigation of 97 soils of the Pas-de-Calais.
- PATTEN, H. E. See CAMERON, F. K. and H. E. PATTEN, I.
- PEGLION, D. V. *Saline Soil of the Lower Valley of the Po (Italy).* Atti della Reale Accademia Economico-Agraria Dei Georgofili di Firenze, v. 5, ser. 3 (1906), No. 1, p. 59-64. Abs., Exper. Sta. Rec., v. 18, p. 215.
Nature and concentration of alkali soil salts in Italy.
- PERKINS, A. J. *Progress Report Concerning Reclamation of Salt Patch at Berri State Experimental Orchard.* Jour. Dept. Ag. So. Australia, v. 27 (1923), No. 4, p. 325-343.
Describes the accumulation of salts due to irrigation and the reclamation of the land by drainage and leaching.
- PETERSON, W. See STEWART, R., and W. PETERSON, I.
- PUCHNER, H. *Concerning the Transport of Soluble Salts by the Movement of Water in the Soil.* Forschungen auf dem Bebeite der Agriculture-Physik, v. 18 (1895), p. 1-25. Abs., Exper. Sta. Rec., v. 7, p. 272.
Laboratory tests of percolation and capillary movement with soils and waters of known composition. Tabular data.
- ROBINSON, J. S. See HARRIS, F. S., and J. S. ROBINSON, I.
- ROLET, A. *Cultivation of Salt Lands.* Journal d' Agriculture Pratique, N. Ser. 9 (1905), p. 710 (3 col. in French) Abs., Exper. Sta. Rec., v. 17, p. 814.
Discusses removal of sodium chloride by flooding and drainage and by cropping with grain.
- SANDSTEN, E. P. *Reclaiming Niter Soil in the Grand Valley.* Colo. Sta. Bul. 235 (1917), 8 p.
Describes reclamation of barren niter-affected land in Colorado by flooding and by furrow irrigation.
- SHARP, L. T. *Fundamental Interrelationships Between Certain Soluble Salts and soil Colloids.* Univ. Calif. Publications in Agricultural Sciences, v. 1 (1916), p. 291-339.
Effects on soil structure of various salts. Tabular data.
- SHAW, G. W. See SNOW, F. J., E. W. HILGARD, and G. W. SHAW, I.
- SHINN, C. H. *Alkali Reclamation at Tulare Substation.* Calif. Sta. Rpt. (1899-1901), Part II, p. 204-212.
Describes reclamation of "black alkali" lands by use of gypsum. Diagrams.
See also LOUGHRIDGE, R. H., and C. H. SHINN, I.
- SHUTT, F. T., and A. H. BROWASH. *Alkali Content of Soils as Related to Crop Growth.* Royal Soc. Canada Proc. & Trans. v. 3, ser. 14 (1920), p. 57-70.
Percentages of various salts in loam soils are stated.
- SHUTT, F. T., and E. A. SMITH. *Alkali Content of Soils as Related to Crop Growth.* Royal Soc. of Canada Trans., ser. 3, v. 12 (1908), p. 83-97.
Discusses origin, nature, and effects of alkali. Gives results of field investigations. Tabular data.
- SIGMOND, A. VON. *On the Types of "SZIK" (alkali) Soils of the Hungarian Alföld.* Foldtani Kozlony, v. 36 (1906), No. 10-12, p. 439-54. Abs., Exper. Sta. Rec., v. 19, p. 1117.
Study and classification of alkali soils.
- SLICHTER, C. A. *Theoretical Investigation of the Motion of Ground Water.* U. S. G. S. An. Rpt. (1897-98), part 2, p. 295-385.
Mathematical consideration of the physical aspect of ground-water movement. Diagrammatic and tabular data. Bibliography. Illustrated.
- SLOSSON, E. C. See KNIGHT, W. C., and E. C. SLOSSON, I.
- SMITH, E. A. See SHUTT, F. T., and E. A. SMITH, I.
- SNOW, F. J., E. W. HILGARD, and G. W. SHAW. *Lands of the Colorado Delta in the Salton Basin.* Calif. Sta. Bul. 140 (1902), 51 p.
Study of the soil, water, and vegetation with respect to alkali.

- STABLER, H. *Irrigating Waters*. U S. G. S. Water Supply Paper 274 (1911), p. 177-181.
Development and methods of application of "alkali coefficient"—an index of salt concentration in water.
- STEPHENSON, R. E. *Activity of Soil Acids*. Soil Science, v. 8 (1919), p. 41-59.
Describes experiments and discusses organic and metallic acids, and adsorption by colloids as causes of acid activity in soils. Tabular data.
- STEVENSON, W. H., and P. E. BROWN. *Improving Iowa's Peat and Alkali Soils*. Iowa Sta. Bul. 157 (1915), 37 p.
Study of the nature of these soils. Drainage and certain farming methods as corrective measures. Diagrammatic and tabular data. Illustrated.
- STEWART, J. See GARDNER, F. D., and J. STEWART, I.
- STEWART, R., and J. E. GREAVES. *Movement of Nitric Nitrogen in Soil and its Relation to "Nitrogen Fixation."* Utah Sta. Bul. 114 (1911), p. 181-94.
Study of nitrates in soil. Tabular data.
- STEWART, R., and W. PETERSON. *Nitric Nitrogen Content of the Country Rock*. Utah Sta. Bul. 134 (1914), 45 p. Utah Sta. Bul. 150 (1917), 20 p. (Continuation of above).
Considers the origin, distribution, evidences and effects of nitrate in the soil, rock and water of western United States. Tabular data. Illustrated.
- . *Origin of Alkali*. Jour. Ag. Research, v. 10 (1917), p. 331-353.
Results of investigations in western United States of soluble salts in the various geological formations. Bibliography, diagrams, and tables.
- . *Origin of "Nitrate Spots" in Certain Western Soils*. Jour. Am. Soc. Agronomy, v. 6 (1915), p. 241-248. Disc., Science, v. 42 (1915), p. 452.
Discusses origin as concentrations of salt leached from country rock rather than bacterial fixation. Tabular data.
- SUTHERST, W. F. *Effect of Gypsum on Alkali Soils*. Jour. Ind. and Eng. Chem., v. 2. (1910), p. 239 (1½ col.).
Laboratory experiment as to completeness of action. Diagrams.
- SYMONDS, R. S. *Experiments with Nitric Acid in Alkaline Soils*. Agricultural Gazette (N. S. Wales), v. 21 (1910), p. 257-266.
Description and results of field tests in reclamation of "black alkali" lands. Illustrated.
- . *Note on Action of Nitric Acid in Neutralizing Alkaline Soil*. Royal Soc. of N. S. Wales. Jour. and Proc. v. 41 (1907), p. 46-48.
Laboratory experiments on wheat grown in flower pots. Illustrated.
- TAMHANE, V. A. See MANN, H. H., and V. A. TAMHANE, I.
- TINSLEY, J. D. *Drainage and Flooding for the Removal of Alkali*. N. Mex. Sta. Bul. 43 (1902), 29 p.
Design, installation, and operation of flooding and drainage systems discussed. Diagrammatic and tabular data.
- TRAPHAGEN, F. W. *Alkali Soils of Montana*. Mont. Sta. Bul. 18 (1898), 27 p. Mont. Sta. Bul. 54 (1904), p. 91-93.
Study of conditions and methods of correction. Tabular data.
- TREITZ, P. *Alkali Soils of the Great Hungarian Alföld*. Foldtani Közlemény, v. 38 (1908), p. 106-131. Abs., Exper. Sta. Rec., v. 20, p. 818.
Origin and composition discussed.
- TULAYKOV, N. *Some Laboratory Experiments on the Capillarity of Soils*. Russ. Jour. Exper. Landw., v. 8 (1907), p. 629-666. Abs., Exper. Sta. Rec., v. 20, p. 517.
Investigation of relation of capillarity to soil alkali of the Muganj Steppe. Three figures.
- TULAYKOV, N. *Soils of the Kirghiz Steppe*. Russ. Jour. Exper. Landw., v. 9 (1908), p. 628-630. Abs., Exper. Sta. Rec., v. 22, p. 617.
Study of these soils with respect to composition and origin of salts present.
- TULAYKOV, N., and P. KOSSOVICH. *Soils of the Muganji Steppe and Their Transformation into Alkali Land by Irrigation*. Izvestiia Moskovskago Sel'skokhoziaistvennago Instituta (Annales, Institute of Agriculture, Moscow), v. 12 (1906), No. 7, p. 27-255. *Ibid.*, v. 12 (1906), No. 2, p. 226-36. Russ. Jour. Exper. Landw., v. 6 (1905), No. 2, p. 176-242. Abs., Exper. Sta. Rec., v. 28, p. 818, 426. Abs., Centralblatt für Agriculturchemie, v. 35 (1906), p. 567.
Detailed report of Russian Government investigation of irrigation by flooding as a cause of alkali lands and preventative measures. Tabular and diagrammatic data. Illustrated.
- VISSOTSKI, G. *Soils Zones of European Russia in Connection with the Salt Content of the Subsoils and with the Character of the Forest Vegetation*. Pochvovedenie (Pedologie), v. 1 (1899), p. 19-26. Abs., Exper. Sta. Rec., v. 12, p. 925.
Study and classification of soils with respect to composition and concentration of salt content.
- WARINGTON, R. *Physical Properties of Soil*. (Oxford, 1900), 231 p.
Lectures on physical properties and relations of soil. Special reference to alkali soils and their treatment. Tabular and diagrammatic data.
- WARNER, H. W. *Good Farming Makes Acid Soils*. Wallace's Farmer, v. 45 (1920), p. 2874 (1 col.).
Discusses leaching, cropping, and manuring as causes. Lime as a remedy.

WEIR, W. W. *Preliminary Report on Kearney Vineyard Experimental Drain*. Calif. Sta. Bul. 273 (1916), p. 103-124.

Description of design, construction, operation, and results of clay tiledrain system in reclaiming a quarter section of land impregnated with alkali through irrigation. San Joaquin Valley, Calif. Illustrations, tables, and diagrams.

WHERRY, E. T. *Soil Acidity and Field Method for its Measurement*. Ecology, v. 1 (1920), p. 160-173.

Discusses hydrogen ionization and its relation to soil acidity. Describes field color measurements. Color chart.

WHITNEY, M., and T. H. MEANS. *Alkali Soils of the Yellowstone Valley*. U. S. Bur. Soils Bul. 14 (1898), 39 p.

Origin, nature, and concentration of soluble salts investigated. Over-irrigation discussed as a cause and underdrainage as remedy. Tabular and diagrammatic data. Illustrated.

EDITORIALS, ANONYMOUS ARTICLES, ETC. *Alkali Investigations [At the California Station]*. Calif. Sta. Rpt. (1922), p. 50, 53.

Gives area in California affected by alkali.

II. ALKALI SOIL SALTS

EFFECTS ON MORTAR AND CONCRETE AND MEASURES FOR PREVENTION

ABRAMS, D. A., and J. E. FREEMAN. *Inspection of Concrete in the Winnipeg District and Conference on Field Tests of Concrete in Alkali Soils*. Portland Cem. Ass'n. Minutes, Appendix A (Sept., 1920), 33 p.

Describes deterioration of Winnipeg aqueduct, inspection of same, and of concrete sewers in Winnipeg and plans for organized field investigation. General discussion of alkali action on concrete in western Canada. Bibliography.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. See III.

ANDERSON, A. O. *Relation of Portland Cement to Iowa's Drainage Development*. Cem. Age, v. 8 (1909), p. 210-214.

Describes tests on solubility of cement tile in water. Tabular data.

ANDERSON, G. G. *Effect of Alkali on Concrete*. A. S. C. E. Trans., v. 67 (1910), p. 572-630. Exc., Cem. Age, v. 10 (1910), p. 268.

General discussion of ill effects of various salts, acids, and gases upon concrete, the causes and methods of prevention. Discussions by Rudolph Hering, Richard L. Humphrey, and others. Considerable technical detail. Numerous accounts of tests, inspections, and specific cases in practice.

ANDERSON, G. G., and others. *Irrigation*. A. S. C. E. Trans., v. 62 (1909), p. 1-66.

General discussion of irrigation. Includes descriptions of concrete structures and alkali effects in western United States.

BARNETT, M. R. See IV.

BARTHOLOMEW, T. See III.

BATES, P. H. *What Properties and Methods of Making Concrete Require Further Investigation*. Concrete, v. 23 (1923), p. 11-14, 37.

Three classes of conditions listed, one of which treats of products subject to a solution of salts, especially sulfates.

BATES, P. H., and others. *Action of the Salts in Alkali Water and Sea Water on Cements*. U. S. Bur. Stand. Tech. Paper 12 (1912), 157 p. Abs., Franklin Inst. Jour., v. 175 (1913), p. 65-67. Abs., Eng. Rec.,

v. 67 (1913), p. 691-692. Abs., Eng. N., v. 70 (1913), p. 50-51. Abs., Munic. Eng., v. 45 (1913), p. 58-59. Abs., Met. & Chem. Eng., v. 11 (1913), p. 442-443. Abs., Jour. Ind. & Eng. Chem., v. 5 (1913), p. 1026. Abs., Ry. Age Gaz., v. 55 (1913), p. 514. Exc., Conc. Cem. Age, v. 3 (1913), p. 71.

Full report on laboratory experiments and field tests (in sea water) covering 3½ years. Physical and chemical tests on mortar specimens and fresh cements. Tabular and diagrammatic data. Illustrated.

BAUCHERE, A. See III.

BEBB, E. C. *Progress in Investigation of Alkali Action on Concrete*. Rcl. Rec., v. 12 (1921), p. 224-227. Abs., Concrete, v. 19 (1921), p. 107.

Reviews Government investigation (see Wig and others—"Durability of Cement Drain Tile and Concrete in Alkali Soils"), and discusses generally the results observed, 1917-1921. Illustrated.

BIED, J. See III.

BISHOP, W. See IV.

BLACKIE, A. G. *Causes of Disintegration of Concrete*. Can. Eng. Inst. Jour., v. 1 (1918), p. 200 (5 col.). Eng. and Cont., v. 50 (1918), p. 503. Can. Eng., v. 35 (1918), p. 231.

Comparison of results and conclusions of investigations by United States Bureau of Standards, Wyoming University, and city of Winnipeg on action of alkali on concrete. Tabular data.

BLEININGER, A. V. *Manufacture of Hydraulic Cements*. Ohio Geological Survey Bul. 3, 4th ser. (1904), p. 364-365.

Effects of salts on cements. Discusses addition of puzzolan as protection against sea water and notes results of experiments with acids on puzzolan cement.

BLOUNT, B. See III.

BROWN, F. W. *Action of Alkali Water on Cement*. Cement, v. 9 (1908), p. 93 (4 col.). Abs., Chem. Abs., v. 2 (1908), p. 2612.

General discussion.

- BROWN, W. L. *Concrete in Alkali Soils*. Conc. Cem. Age, v. 2 (1913), p. 291 (4½ col.). Cem. & Eng. N., v. 25 (1913), p. 209-210.
Describes failure of 10-inch pipe line in California. Discusses alkali soil as cause. Comments by L. T. Bachman.
- BURCHARTZ. See IV.
- BURCHARTZ, H., and J. V. WROCHEM. See VI.
- BURDICK, R. T. *Cement Drain tile in New England*. Rural N. Y., v. 76 (1917), p. 7 (½ col.).
Discusses clay versus cement tile.
- BURKE, E. See TANNATT, E. T., and E. BURKE. II.
- BURKE, E., and R. M. PINCKNEY. *Action of Alkali Salts upon Portland Cement*. Jour. Ind. & Eng. Chem., v. 3 (1911), p. 317-321. Abs., Chem. Abs., v. 5 (1911), p. 2420.
Discusses with considerable detail the effects of various salts. Describes laboratory experiments with results and conclusions. Tabular data.
- BURKE, E., R. M. PINCKNEY and E. T. TANNATT. *Effect of Alkali on Portland Cement*. Mont. Sta. Bul. 81 (1910), 131 p. Prelim. Rpt., same, Bul. 69 (1908). Abs., Eng. N., v. 60 (1908), p. 101. Abs., Eng. Rec., v. 58 (1908), p. 11. Ed. comment, Eng. & Contr., v. 2 (1908), p. 2438. Ed. comment, Cem. Age, v. 8 (1909), p. 467.
Laboratory tests of cement and mortar specimens in salt solutions. Discussion of tests and deductions. Tabular and diagrammatic data. Illustrated.
- CHACE, W. G. *Alkali Soils of Prairie Provinces Cause Decay of Concrete Structures*. Contract Rec., v. 34 (1920), 538 (5 col.). Concrete, v. 17 (1920), Mill Sect., p. 44-45. Disc., Contract Rec., v. 34 (1920), p. 844.
Notes failures in western Canada and United States. Discusses briefly sewer and aqueduct disintegration at Winnipeg. Describes tests of preventative measures. Illustrated.
- COUGHLAN, R. R., and R. A. HART. *Protection of Concrete Against Alkali*. Conc. Cem. Age, v. 7 (1915), p. 33 (2 col.).
Rich mix as protection.
- CUSHMAN, A. S. *Alkali Protection*. A. P. C. M. Min., May, 1912, p. 15, 32; May, 1913; Dec., 1913.
- DAWSON, A. S. *Concrete in Alkali Soils and Waters*. Can. Eng., Inst., Jour., v. 3 (1920), p. 476 (15 col.). Eng. & Contr., v. 54 (1920), p. 388. Can. Eng., v. 39 (1920), pp. 474 and 500. Abs., Chem. Abs., v. 15 (1921), p. 156.
Summarizes origin of alkalies and the causes and nature of attack on concrete. Notes conditions in practice. Discusses field tests and conclusions to date by Calgary branch of Eng. Inst. of Canada. Suggests preventative features. Discussions by B. S. McKenzie and C. J. Mackenzie.
- DAWSON, A. S. *Report of Calgary Committee on Deterioration of Concrete in Alkali Soils*. Can. Eng. Inst. Jour., v. 4 (1921), p. 490-492.
Results secured since 1918 summarized.
- . *Tests of Concrete in Alkali Soil*. Eng. & Contr., v. 56 (1921), p. 403-404.
Abstract of paper presented to Engineering Institute of Canada giving results of experiments with concrete blocks and cylinders.
- DAY, W. H. *Cement Tile Experiments at the Ontario Agric. College*. Can. Eng., v. 20 (1911), p. 759-762.
Describes investigation of cost of manufacture and yield of cement tile. Also strength and porosity tests and tests of solubility of tile of various mixes subjected to distilled and natural waters. Tabular data.
- DEVAL. See IV.
- DIECKMAN, G. P. See SIMS, C. E., and G. P. DIECKMAN. II.
- D'ROHAN, W. *Chemical Destruction of Concrete Structures and the Search for a Panacea*. Concrete, v. 9 (1916), Mill Sect., p. 11-14.
General discussion, with current opinions. Suggestions as to remedial measures.
- . *Protection of Concrete Structures from Alkali and other Destructive Agents*. Eng. & Contr., v. 39 (1913), p. 570-571. (Ed. comment, p. 566). Abs., Chem. Abs., v. 7 (1913), p. 246.
Discusses action on concrete of alkali water and rain water. Tests with distilled water. Use of puzzolan and slag cement.
See also III.
- DYCKERHOFF, A. *Tests of Concrete in Marsh Water*. Cement, v. 17, p. 66-67. Chem. Zeit., v. 36, p. 464. Abs., Chem. Abs., v. 6 (1912), p. 1832.
Tests of concrete of four different sands. Also permeability tests with various waterproofing materials.
- ELLIOTT, G. R. B. *Are Concrete Tile Durable?* Wis. Sta. Bul. 323 (1920), p. 39. Abs., Exper. Sta. Rec., v. 45 (1921), p. 289.
Notes disintegration in acid and peat soils. Specifications for cement tile.
- ENDEL. *Lectures on Recent Cement investigations*. Zement, (1921), No. 42, p. 527-529; No. 43, p. 542; No. 45, p. 571-572; No. 47, p. 598-599; No. 48, p. 640-641; No. 49, p. 621-625; No. 50, p. 635-638; No. 51, p. 650-651; No. 52, p. 654-660; (1922), No. 1, p. 3-6.
- ENDELL, K. See IV.
- ENGINEERING INST. OF CANADA. *Observations of Concrete Failures in Alkali Soils*. Can. Eng. Inst. Jour., v. 1 (1918), p. 203 (7 col.). Can. Eng., v. 35 (1918), p. 233 and 235.
Committee report. Chemical analyses of soils and concretes where disintegration has occurred. General conclusions as to action taking place, and methods of preventing. Outline plan of future investigations by committee.

ERDAHL, B. F. *Effect of Alkali water on Concrete*. Concrete, v. 17 (1920), Mill Sect., p. 23-24. Abs., Chem. Abs., v. 14 (1920), p. 2979. Disc., Concrete v. 17 (1920), Mill Sect., p. 53-54.

Discusses physical and chemical aspects of action.

— *New Weapon to Fight Alkali*. Concrete, v. 19 (1921), p. 181.

Discusses a patented soluble compound for preventing alkali action on concrete.

EWERS, C., and others. *Is Cement Tile Durable?* Rural N. Y., v. 75 (1916), p. 146 (1½ col.).

Experiences and opinions of users pro and con.

FERET, E. *Prolonged Tests of Strength and Decomposition of the Principal Types of Hydraulic Binders: Answer*. Ann. des P. et Chs. (1922), pt. 4, July and Aug., p. 5-33.

FERGUSON, L. R. See WIE, R. J., and L. R. FERGUSON. III.

FIELD, F. C., and others. *Calgary Committee Conducting Experiments with Concrete in Alkali Soil*. Can. Eng., v. 35 (1918), p. 233-234. (Ed. comment, p. 235).

Committee report Calgary branch of Eng. Inst. of Canada concerning failures of concrete in alkali soils. Outline of tests planned.

FINLAYSON, J. N. *Report of Manitoba Committee on Deterioration of Concrete in Alkali Soils*. Can. Eng. Inst. Jour., v. 4 (1921), p. 492-494.

Observations on concrete structures near Winnipeg and results of laboratory tests.

FISK, A. J. *Effect of Alkali Water on Cement Mortars*. Eng. N., v. 64 (1910), p. 168. Cem. Age, v. 11 (1910), p. 199. Cem. & Eng. N., v. 22 (1910), p. 378-379. Abs., Chem. Abs., v. 4 (1910), p. 3127.

Describes limited tests at Wisconsin University laboratory on effect of mixing and curing mortar specimens with alkali water.

FORTIER, S. *Concrete Lining as Applied to Irrigation Canals*. U. S. D. A. Bul. 126 (1914), 86 p.

Design, construction, and operation. Extensive tables of seepage data for unlined and hydraulic data of lined canals. Precautions against alkali and temperature effects. Numerous descriptions of projects. Tabular data. Illustrated.

FREEMAN, J. E. See ABRAMS, D. A., and J. E. FREEMAN, II.

FURLONG, I. *Alkali Attack on Concrete Roads and Building Brick*.

Eng. N. Rec., v. 89 (1922), p. 64-67. Contribution from United States Bureau of Standards relating to tests in Glenn County, Calif.

GARY, M. See IV.

GOFFETTE, J. L. See III.

GOLDRICH. *Action of German Bog Soils on Cement*. Chem.-Zeit., v. 34, p. 419.

GREENE, J. F. *Concrete in Western Canada*. Can. Eng., v. 34 (1918), p. 342-344.

General discussion of concrete disintegration in western Canada. Review of alkali-concrete investigations and suggestions for further tests.

— *Effect of Alkali Soils on Concrete*. Eng. & Contr., v. 49 (1918), p. 465-466.

Discusses occurrence, causes, and prevention with special reference to western Canada. (Abs. of paper before Winnipeg section of Canadian Soc. C. E.)

GREENMAN, R. S. See IV.

HAND, G. H. *Alkali-Corroded Steel Water Main Protected by Concrete*. Concrete, v. 19 (1921), p. 95-96.

Two-inch reinforced concrete shell placed on 33-inch steel water pipe to protect from alkali action. Southern California. Illustrations.

HART, R. A. *Effect of Alkali on Concrete*. A. S. C. E. Trans., v. 67 (1910), p. 587-591. Office of Experiment Stations (U. S. D. A.) An. Rpt., 1910.

Discussion of a paper of same title by G. G. Anderson. Describes laboratory tests made at Utah University on specimens gauged with and exposed to waters with various salt contents. Also tests of a waterproofing mixture. Tabular data.

See also COUGHLAN, R. R., and R. A. HART, II. WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER, II.

HEADDEN, W. P. *Destruction of Concrete by Alkali*. Colo. Sta. Bul. 132 (1908), 6 p. Munic. Eng., v. 37 (1909), p. 112.

Laboratory experiments with discussion and tabular data.

HEISE, C. A. See IV.

HERING, R. *Effect of Alkali on Concrete*. A. S. C. E. Trans., v. 67 (1910), p. 592-597.

Discussion of paper of same title by G. G. Anderson. Discusses action of salts, acids, and gases. Reference to numerous examples of failure and resistance. Tabular data.

HERMANN, Dr. *Behavior of Hydraulic Binders in Waters Containing Sulphates; Protection Against the Disintegration of Concrete*. Ton. Zeit., No. 85 (July 22, 1922). HEUBLEIN, O. See TILLMAN, J. and O. HEUBLEIN, IV.

HOOL, G. A. and N. C. JOHNSON. See III.

HUMPHREY, R. L. See III.

HUMPHREY, R. L. and J. S. SEWELL. See III.

JEWETT, J. Y. *Cement and Concrete Work of the U. S. Reclamation Service with Notes on the Action of Alkali Waters*. A. S. T. M. Proc., v. 8 (1908), p. 480-493. Abs., Cem. Age, v. 7 (1908), p. 18. Abs., Chem. Abs., v. 3 (1909), p. 2365-2367.

Brief outline of activities and methods of United States Reclamation Service in cement testing and concrete construction. Short review of experience with alkali-affected concrete and available information on such action.

See also VI.

- JOHNSON, N. C. See HOOL, G. A., and N. C. JOHNSON, III.
- JOINT COMMITTEE (ENG. SOCIETIES). See III.
- KLEINSCHMIDT, H. S. *Alkali and Concrete Pipe*. Concrete, v. 19 (1921), p. 81.
Cites cases of successful use of cement tile in alkali soils of Utah.
- . *Use of Concrete in Alkaline Soils*. Concrète, v. 21 (1922), p. 148-149.
Further results of observations on concrete tile in alkaline soil in Utah.
- LE CHATELIER, H. See III.
- LIBERTON, P. T. *Concrete in Drainage and Irrigation*. Am. Soc. Ag. Eng. Trans., v. 7 (1913), p. 135-145.
Discusses manufacture and requirements of cement tile, alkali effects, and use of cement tile in drainage. Discussed by several authorities. Diagram.
- LIPPINCOT, J. B. See VI.
- LOTT, H. C. *Effect of Alkali on Concrete*. Eng. N. Rec., v. 89 (1922), p. 577.
Letter written from Basrah, Mesopotamia, giving opinion based on observations.
- MACKENZIE, C. J. *Concrete Mixtures in Alkali Soils*. Can. Eng. Inst. Jour., v. 3 (1920), p. 176 (9 col.). Can. Eng., v. 38 (1920), p. 344-346.
Reviews known facts and theories as to disintegration and its prevention. Outlines field and laboratory tests carried out by the Eng. Inst. of Canada.
- . *Deterioration of Concrete in Alkali Soils*. Can. Eng. Inst. Jour., v. 6 (1923), No. 2, p. 57-63.
Report of special committee of Engineering Institute of Canada.
- MAGRUDER, F. C. See WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER. II.
- MARKUS, O. See IV.
- MARTIN, J. W. See WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER. II.
- MCCRORY, S. H. *Effect of Alkali Upon Concrete*. Pub. Rds., Oct., 1920, p. 23-25. Pub. Wks., v. 50 (1921), p. 390-392.
Discusses action on concrete of various soluble salts in soil water. Suggests preventative measures. Tabular data. Illustrated.
- . *Effect of Alkali Upon Concrete*. Cem. & Eng. N., v. 34 (1922), p. 17-18.
Contains recommendations as to aggregates, proportioning, and placing concrete to minimize harmful effects of alkali.
- McKENZIE, B. S. *Deterioration of Concrete*. Can. Eng. Inst. Jour., v. 1 (1918), p. 150 (6 col.).
Discusses deterioration of plain and reinforced concrete foundations and sewers in alkali soils of Winnipeg district. Chemical analyses of soils and waters.
- McVAY, C. B. *Portland Cement Drain-tile and Their Importance in Reclamation Work*. Concrete, v. 8 (1908), No. 4, p. 24-25.
Discusses efficiency, cost, and durability.
- MEADE, R. K. *Action of Various Substances on Cement Mortars*. A. S. T. M. Proc., v. 13 (1913), p. 813-820. Abs., Eng. N., v. 70 (1913), p. 21-23. Abs., Eng. R., v. 68 (1913), p. 20-21. Abs., Conc. Cem. Age, v. 3 (1913), p. 59.
Account of tests made on mortar briquettes in various salt solutions. Tabular data and results. Discussions.
- MILLER, D. G. *Action of Alkali Salt on Portland Cement Mortars*. Eng. & Contr., v. 57 (1922) p. 359-360.
Results of experiments at Minnesota laboratory with test cylinders.
- . *Effect of Alkali on Concrete Drain-tile and General Conditions of Alkalinity in Southwestern Minnesota*. Minnesota Federation of Architectural & Engineering Societies Bulletin, Aug. 1921, p. 13-16. Abs., Pub. Wks., v. 51 (1921), p. 292-294.
Contains precautions to designing engineers in laying concrete in alkali soil.
- . *Field Investigations of Concrete Tile Failures in Southwestern Minnesota*. U. S. D. A. Bur. Public Roads, Rpt. 1920, 33 p.
Describes field investigations and tests of tile failures in alkali soil. Water and soil analyses. Tabular data, conclusions. Illustrated.
- . *Report of Concrete - Alkali Investigations in Minnesota, 1919-1920*. Minnesota. Dept. of Drainage and Waters (July, 1921), 74 p. Abs., Eng. N. Rec., v. 88 (1922), p. 967. Abs., Cem. & Eng. N., v. 34 (1922), p. 17.
Progress report of experiments at laboratory of Minnesota Experiment Station in cooperation with United States Department of Agriculture on action of alkali salt on Portland cement mortars. Contains analyses of tile after exposure to alkaline soil, danger limit of sulphates. Tabular data.
- MILLER, D. G. and E. V. WILLARD. *Concrete Pipe in Alkali Soils*. Pub. Wks., v. 51 (1921), p. 292-294.
Discusses action of alkali on cement drain-tile in Minnesota.
- MORRISON, H. C. See NEWBERRY, S. B., and A. C., and H. C. MORRISON, II.
- MUSSELMAN, H. H. See WINTER, O. B., and H. H. MUSSELMAN, II.
- NEW YORK (CITY) BOARD OF WATER SUPPLY. *Effects of Acids and Alkaline Solutions on Mortar*. N. Y. (City) Water Supply Bd. An. Rpt., v. 8 (1913), p. 66. Abs., Eng. R., v. 70 (1914) p. 271.
Discusses action of ground water.

- NEW YORK (CITY) BOARD OF WATER SUPPLY.** *Relation of Porosity to Disintegration in Concrete.* N. Y. (City) Water Supply Bd. An. Rpt., v. 8 (1913), p. 66. Abs., Eng. R., v. 70 (1924), p. 268. Abs., Chem. Abs., v. 9 (1915), p. 139.
Describes tests showing injury to concrete by continuous percolation.
- NEWBERRY, S. B. and A. C., and H. C. MORRISON.** *Integral Waterproofing for Concrete.* St. Louis Eng. Club Jour., v. 2 (1917), p. 297-302.
Discusses relative merits of surface and integral waterproofing and their action. Notes tests of a commercial integral waterproof compound.
- NEWHALL, C. A.** *Action of Ground Waters on Cement Sewer Pipe.* Contract Rec. (Mar. 29, 1922), p. 287.
- NITZSCHE, H.** *Behavior of Cement in Water Containing Sulphuric Acid.* Sci. Am. S., v. 83 (1917), p. 334.
Results of tests of sulphuric acid on Portland, iron-ore, and blast-furnace-slag cements.
- *Behavior of Different Cements in Solutions of Sodium and Magnesium Sulphates of Varying Concentration.* Technik und Industrie (1919), p. 81-90.
- *Calcium Aluminum Sulphate as a Destroyer of Concrete.* Zeit. Ang. Chem., v. 31 (1918), pt. I, p. 195-196. Ibid., v. 32 (1919), pt. I, p. 21-24. Abs., Soc. Chem. Ind. Jour., v. 35, p. 173a. Abs., Soc. Chem. Ind. Jour., v. 38, p. 178a. Abs., Soc. Chem. Ind. Jour., Nov. 10, 1919. Abs., Conc. & Const. Eng., Nov., 1919. Abs., Chem. Abs., v. 13, p. 1006 and 2748.
Technical discussion of action and preventative measures.
- ORTON, E., JR., and others.** *Use of Cement in Sewer Pipe and Drain-tile Construction.* A. P. C. M. Bul. 19 (1908), 43 p. Disc., Cem. Era, v. 6 (1908), p. 164-165.
Opinions pro and con, concerning efficiency of concrete pipe for sewers and drains. Concrete versus clay. Mainly a defense of concrete.
- PETRY, V.** See IV.
- PIERCE, G.** *Destructive Action of Alkali upon Concrete.* Mining Science, v. 63 (1911), p. 130 (4 col.). Abs., Chem. Abs., v. 5 (1911), p. 1503.
Discusses action and describes a new low-lime-high-silica "alkali-proof" cement manufactured in Colorado. Tabular data of composition, strength, tests, etc. Illustrated.
- PINCKNEY, R. M.** See BURKE, E. and R. M. PINCKNEY, II. BURKE, E., R. M. PINCKNEY, and E. T. TANNATT, II.
- PINKERTON, P. W.** *Second Rebuilding of Waterworks, Montrose, Colo.* Eng. N., v. 73 (1915), p. 883-884.
Describes failure due to alkali of wood-stave conduit.
- POTTER, C. J.** See VI.
- PULVER, H. E.** See IV.
- RAMSOWER, H. C.** *Cement Drain Tile.* Sci. Am., v. 120 (1919), p. 30.
Suggestions as to manufacture and use. Cement against clay tile discussed briefly.
- REBUFFAT.** See III.
- REYES, F. D.** See WITT, J. C., and F. D. REYES, IV.
- RICHARDSON, R. D.** See IV.
- RODT, V.** See IV.
- ROHLAND, P.** *Action of Magnesium Salts on Concrete and Reinforced Concrete.* Zeitschrift des Vereins deutscher Ingenieure, v. 56, p. 1720-1721. Abs., Chem. Abs., v. 7 (1913), p. 544.
Discusses action, and trass admixture as preventative.
- *Cement Preservative, "Nigrit."* Ton. Zeit., v. 32, p. 52, also p. 698. Abs., Chem. Abs., v. 2 (1908), p. 2136.
Discusses merits of this commercial product as a protection against solutions, acids, etc.
See also IV.
- SARTORI, A.** *Action of Sulphates on Concrete.* Chem. Zeit., v. 39 (1915), p. 957.
- SCHICK, E.** *Destruction of Concrete by Constituents of the Soil.* Ton. Zeit., v. 36, p. 358. Abs., Chem. Abs., v. 6 (1912), p. 1833.
Discusses action of soluble sulphates.
- SCHIFFNER.** See IV.
- SCHLICK, W. J.** *Investigations of Test Methods for Determining the Durability of Concrete Drain-tile in Alkali Soils.* Iowa State College, Progress report, March, 1922.
- SCHOTT.** See IV.
- SEWELL, J. S.** See HUMPHREY, R. L. and J. S. SEWELL, III.
- SIMS, C. E. and G. P. DIECKMAN.** *Effects of Alkali on Concrete Drain-tile.* Conc. Cem. Age, v. 6 (1915), p. 278-281. Abs., Chem. Abs., v. 9 (1915), p. 2137.
Full description of manufacture, installation, and disintegration of 22-inch drain in Iowa, and chemical investigation of conditions. Tabular data.
- SMITH, G. E. P.** *Failure of a Concrete Pipe Conduit.* Eng. N. Rec., v. 83 (1919), p. 113-115.
Describes peculiar failure of 20-inch concrete pipe in Arizona and discusses tests indicating the cause to be differential expansion due to absorption. Diagrammatic data. Illustrated.
- SPACKMANN, H. S.** *Relation of the Lime Content of Cement to Durability of Concrete.* Concrete (1911), No. 2, p. 52-53. Abs., Chem. Abs., v. 5 (1911), p. 3505-3506.
Discusses action of salt waters and the causes and prevention. Special reference to lime content.

- SPLITTERGERBER, A. *On the Destruction of Cement and Concrete Pipes, Collecting Basins and Masonry for Sewers and the Like, and on Suitable Measures for Protection.* Abwasser, 1920, No. 17, p. 677. Zeitschrift für Wasserversorgung, 1920, p. 46-51.
- SPREGLBURG. *Effect of Calcium Sulphate and Calcium Chloride on Cement.* Ton. Zeit., v. 33 (1909), p. 2189.
- STALEY, H. F. *Comparison between Sodium Sulphate and Freezing Tests of Drain tile.* Am. Cer. Soc. Trans., v. 18 (1916), p. 642-681.
Series of comparative tests to determine the value of the sodium sulphate test as a substitute for the freezing test. Much tabular data.
- STEIK, K. *Effect of Alkali on Portland Cement.* Wyo. Sta. Circ. 16 (1922), p. 4.
Summary of results of several years' study at the Wyoming station.
- *Effect of Alkali upon Portland Cement.* Wyo. Sta. Bul. 122 (1919), 38 p. Prog. Rpt. *Ibid.*, Bul. 113 (1917) 122 p. Abs., Chem. Abs., v. 10 (1917), p. 2134. Abs., Chem. Abs., v. 11 (1917), p. 3407.
Laboratory tests on cement and mortar specimens in salt solutions. Discussion of tests and deductions. Diagrams and tables. Illustrated.
- STEWARTSON, C. W. *Effect of Alkali on Cement.* Brick, v. 33 (1910), p. 102. Conc. Eng., May, 1910.
Clay versus cement tile.
- STUTZER. See IV.
- TANNATT, E. T. *Alkali as a Source of Danger to Concrete Dams; Letter.* Eng. Rec., v. 64 (1911), p. 667-668.
Short discussion of action of alkali on mass concrete. Illustrated.
- See also BURKE, E., R. M. PINCKNEY, and E. T. TANNATT II.
- TANNATT, E. T., and E. BURKE. *Destruction of Cement Mortar and Concrete by Alkali at Great Falls, Mont.* Eng. & Contr., v. 29 (1908), p. 376-377. Noted, Mining Science, v. 57 (1908), p. 464.
Describes inspections, tests and conclusions regarding deterioration of concrete and cement-mortar brick sewers in alkali soil.
- THORVALDSON, T. *Chemistry of Portland Cement and its Disintegration by Alkaline Ground Waters.* Can. Eng. Inst. Jour., v. 5 (1922), p. 457-460.
Honorary advisory council for scientific and industrial research of Canada. Report of the administrative chairman for the year ending March 31, 1923, p. 42-48.
Brief outline of the chemical changes occurring during the manufacture of cement and the manner in which alkali salts disintegrate concrete.
- TILLMANS, J. *Injurious Effect of Swamp Soil and Swamp Water upon Concrete.* Gesundheits-Ingenieur, v. 34, p. 161. Abs., Chem. Abs., v. 5 (1911), p. 1811.
Discusses acids and salts which may prove injurious. Suggests method for analyzing swamp water.
- TILLMANS, J., and O. HEUBLEIN. See IV.
- TOCH, M. See IV.
- TUNISON, A. C., and others. *Concrete in Alkali Soils.* Conc. Cem. Age, v. 3 (1913), p. 69-71.
Experiences and opinions of engineers and manufacturers as to action. Introduction and summary of Bureau of Standards, Technological Paper No. 12.
- See BATES, P. H., and others, II.
- VAUGHN, Z. N. *Building a Reinforced Concrete Pipe Line in Alkali Soil.* Idaho Eng. Soc. Jour., May, 1911. Abs., Eng. N., v. 65 (1911), p. 787-788. Disc., Eng. N., v. 66 (1911), p. 379. Disc., Eng. N., v. 66 (1911), p. 150.
Describes installation of irrigating system and precautions to prevent deterioration.
- WALTER, R. F. *Condition of Pure Iron Pipe Siphon in Alkali Soils.* Eng. Rec., v. 70 (1914), p. 614.
Describes behavior of pure iron and concrete subjected to alkali action in Colorado.
- WATERBURY, L. A., R. A. HART, J. W. MARTIN, and F. C. MAGRUDER. *Symposium on the Protection of Concrete Against Alkali.* Conc. Cem. Age, v. 6 (1915), p. 89-92.
Rich mixtures and linseed-oil coating discussed. Includes results of some experiments and observations. Illustrated.
- WEIR, H. M. *Concrete in Alkali Soil at Saskatoon.* Can. Eng. Inst. Jour., v. 1 (1918), p. 153 (4 col.). Can. Eng., v. 35 (1918), p. 221.
Discusses concrete failures in alkali soils at Saskatoon, Canada. General conclusions.
- WHITE. See IV.
- WIG, R. J., and L. R. FERGUSON. See III.
- WIG, R. J. and others. *Durability of Cement Drain tile and Concrete in Alkali Soils.* U. S. Bur. Stand. Tech. Paper 95 (1917), 94 p. and suppl. Abs., Eng. & Contr., v. 49 (1918), p. 170-2. Later results, Rel. Rec., v. 12 (1921), p. 224-227. Later results, Sci. Am. M., v. 2 (1920), p. 178. Prog. Rpt., U. S. Bur. Stand. Tech. Paper 44, (1915), 56 p. Prog. Rpt., Rel. Rec., v. 7 (1916), p. 369-370. Prog. Rpt., Concrete, v. 7 (1915), p. 145-147, and v. 8 (1916), p. 205. Prog. Rpt., Metal Worker, v. 86 (1916), p. 436. Concl., Franklin Inst. Jour., v. 183 (1917), p. 625-628. Concl., Eng. N. Rec., v. 78 (1917), p. 81 and 277. Concl., Concrete, v. 11 (1917), p. 16-17. Concl.,

Eng. & Contr., v. 47 (1917), p. 249-250. Concl., Can. Eng., v. 35 (1918), p. 231. Concl., Rel. Rec., v. 8 (1917), p. 146-148. Noted, Rel. Rec., v. 7 (1916), p. 68-69. Noted, Eng. & Contr., v. 45 (1916), p. 257. Noted, Eng. N., v. 71 (1914), p. 480.

Detailed description of tests (1913-1917) on cement tile and concrete blocks in alkali soils and waters in 11 widely scattered western localities. Tabular data of chemical and physical tests and manufacture of specimens. Record and discussion of results. Numerous illustrations, diagrams, and tables.

See also VI.

WILLARD, E. V. See MILLER, D. G., and E. V. WILLARD, II.

WILLIAMS, G. M. *Behavior of Concrete Exposed to Alkaline Conditions*. A. S. T. M. Proc., v. 23 (1923), pt. 2, p. 205-210. Abs., Eng. & Contr., v. 60 (1923), p. 288-290. Abs., Eng. N. Rec., v. 91 (1923), p. 56-57.

Review of past experiments with summary. Discussion by E. E. Butterfield and R. J. Wig.

— *Disintegration of Concrete in Alkali Soils*. Contract Rec., v. 35 (1921), p. 805 (7 col.).

General discussion of nature of action. A review and summary of results and conclusions by American investigators. General conclusions by the author.

— *Durability of Cement Drain Tile and Concrete in Alkali Soils*. U. S. Bur. Stand. Tech. Paper No. 214 (1922), p. 463-494. Abs., Eng. N. Rec. v. 89 (1922), p. 181.

Third progress report of cooperative experiments.

— *Durability of Concrete in Alkali Soils*. Can. Eng. v. 43 (1922), p. 533-534.

Outline of investigations in progress in field and laboratory.

— *Review of Investigations into Deterioration of Concrete in Alkali Soils*. Can. Eng. v. 42 (1922), p. 209-210.

Report to Engineering Institute of Canada outlining investigations.

WINTER, O. B., and H. H. MUSSELMAN, *Durability of Concrete Drains (I and II)*. Mich. Sta. (Special) Bul. 75 (1915) (I), 13 p. Mich. Sta. (Special) Bul. 82 (1917) (II), 12 p. Abs., Exper. Sta. Rec., v. 39 (1918), p. 393. Mich. Ag. Bd. An. Rpt. (1916), p. 349-359.

Describes failures in Michigan soils. Laboratory experiments on effects of various solutions seeping through tile walls. Impermeability tests on mortars of certain proportions. Tabular results with discussion. Illustrated.

WITT, J. C. *Effect of Calcium Sulphate on Cement*. Concrete, v. 16 (1920), Mill Sect., p. 32-35.

Laboratory tests of time of setting, soundness and normal consistency with various percentages of the sulphate. Tabular data.

WITT, J. C. *Effect of Sulphide on Cement*. Philippine Jour. Sci., v. 11-A (1916), p. 273-288.

Setting time and tensile strength tests on specimens gauged with sodium sulphide solutions. Results checked with hydrogen sulphide solutions. Special reference to iron content of the cement. Conclusions as to chemical and physical action. Tabular data. Illustration.

— *Some Generalizations on the Influence of Substances on Cement and Concrete*. Philippine Jour. Sci., v. 13-A (1918), 20 p. Abs., Exper. Sta. Rec., v. 42 (1920), p. 581.

Tests for effects on tensile strength and initial set of gauging with solutions of various salts. Includes a bibliography with short abstracts. Tabular data.

— *Some Generalizations on the Influence of Substances on Cement and Concrete*. Philippine Jour. Sci., v. 21 (1922), No. 4, p. 365-371.

Second progress report on effect of 11 salts on setting time and strength of cements.

WITT, J. C., and F. D. REYES. *Effect of Calcium Sulphate on Cement*. Philippine Jour. Sci., v. 12-A (1917), p. 133-143. Abs., Chem. Abs., v. 12 (1918), p. 616-617.

Ninety-day laboratory tests for effects of gypsum and plaster of Paris on tensile strength and time of setting. Also of carbon dioxide and sodium carbonate which may be formed during storage. Tabular data.

EDITORIALS, ANONYMOUS ARTICLES, Etc. *Alkali Action on Concrete*. Rel. Rec., v. 7 (1916), p. 68-69. Abs., Eng. & Contr., v. 45 (1916), p. 257. Abs., Eng. Rec., v. 73 (1916), p. 316. Abs., Conc. Cem. Age, v. 8 (1916), p. 205. Abs., Chem. Abs., v. 10 (1916), p. 1419.

Short discussion of action and preventative measures. Cases cited.

— *Alkali from Plaster as a Danger to Concrete*. See IV.

— *Alkali Damages Part of Winnipeg Concrete Aqueduct*. Eng. N. Rec., v. 84 (1920), p. 1097-1098. Concrete, v. 19 (1921), p. 205.

Describes method for subdraining an 8-foot alkali-affected reinforced concrete aqueduct by uncovering and underfilling with gravel in which are placed tile drains.

— *Alkali Soil Experiences in Minnesota*. Can. Eng., v. 43 (1922), p. 445.

Reference to report of department of drainage and waters of State of Minnesota for years 1919-20.

— *Alkali Soils, the Effect on Concrete*. Eng. N., v. 60 (1908), p. 101-102.

Editorial comment on conditions in western United States.

— *Calcium Aluminum Sulphate, Effect on Concrete*. Eng. & Contr. v. 52 (1919), p. 755.

Discusses formation, action and means of preventing destructive effects.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—(Cont.) *Calcium Aluminum Sulphate as a Destroyer of Concrete*. Conc. & Const. Eng., v. 14 (1919), p. 685. Abs., Chem. Abs., v. 13 (1919), p. 2748.

Discusses nature of action and methods of preventing.

— *Destructive Agents and Protective Treatments*. Concrete, v. 22 (1922), p. 73, 74.

Report of committee E-6 of American Concrete Institute Convention at Cincinnati, Jan. 22 to 25, 1923.

— *Drain tile in Alkali Soils: Discussion*. A. P. C. M. Min., June, 1908, p. 16.

— *Drain tile Tests Show Concrete Affected by Alkali*. Eng. N. Rec., v. 89 (1922), p. 181.

Report of observations of test tile placed in alkali soil in 1913.

— *Effect of Soil Alkalis on Concrete Tile in Southwestern Minnesota*. Eng. & Contr., v. 58 (1922), p. 262–263.

Summary and conclusions of results of investigations in Minnesota in 1919–20 with concrete drain tile.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—(Cont.) *German Concrete Society (Berlin), Meeting of*. Chem. Zeit., v. 32 (1908), p. 394. Abs., Chem. Abs., v. 2 (1908), p. 2139.

Includes note on preventing action of carbonic acid in ground water by coating concrete with "Inertol."

— *Impregnated Concrete Pipes*. Sand og cement (Danish), November, 1920.

Describes Danish patent on process for impregnating concrete pipes as substitute for glazed stone-ware pipes.

— *Investigations of Effect of Alkali on Concrete Drain tile not Convincing*. Concrete, v. 19 (1921), p. 107–108.

Comment on cooperative report of Bureau of Standards, Reclamation Service, et al., as published in Reclamation Record for May, 1921.

— *Sulphuric Acid and Carbonic Acid, Action on Concrete*. See IV.

— *Water, Gas Tar and Coal Tar, How to Use on Concrete*. See VI.

III. SEA WATER

EFFECTS ON MORTAR AND CONCRETE AND MEASURES FOR PREVENTION; SEA-WATER STRUCTURES OF CONCRETE.

ABERTHAW CONSTRUCTION CO. *Aberthaw Tests of Concrete in Sea-water*. Aberthaw Construction Co. (Boston). Report, 1920, 36 p. Exten. Abs., Eng. N. Rec., v. 86 (1921), p. 121–123. Exten. Abs., Eng. & Contr., v. 55 (1921), p. 290. 1916 results, A. S. C. E. Trans., v. 81 (1917), p. 645–675; disc., p. 676–708. 1916 results, Eng. & Contr., v. 47 (1917), p. 74–75, 199. 1913 results, Aberthaw Construction Co. Report, 1913. 1913 results, Eng. N., v. 70 (1913), p. 1023. 1913 results, Eng. Rec., v. 69 (1914), p. 344. 1913 results, Eng. & Contr., v. 41 (1914), p. 516–518. 1913 results, Balt. Eng. Club Jour., v. 5 (1915–16), No. 6, p. 2–10. 1913 results, Chem. Abs., v. 8 (1914), p. 412, 1665. 1911 results, Eng. Rec., v. 64 (1911), p. 229–231. 1910 results, Cem. Age, v. 13 (1911), p. 155–157. 1910 results, Conc. Cem. Age, v. 4 (1916), p. 273–274. Outlined, Cem. Age, v. 8 (1909), p. 147–150. Noted, Pub. Wks., v. 50 (1921), p. 374.

One, four, and eleven year results of continuous tests on 24 piers of reinforced concrete of various proportions and cements, conducted at United States navy yard, Charlestown, Mass., to determine chemical and mechanical effects of sea water upon concrete. Detailed report on chemical and physical tests of concrete materials, methods of manufacture and curing specimens, operation of tests and results to date. Excellently illustrated tabular description of manufacture and behavior of each specimen.

ALAYENE, M. R. *Alumina Cement*. Concrete, v. 20 (1922), p. 73–75. Abs., Science et Industrie, Nov. 3, 1921.

A mixture of limestone or lime and bauxite. Unaffected by sulphurous and sea waters.

ALEXANDER, M. P. *Experimental Researches on Hydraulic Mortars*. Ann. des P. et Chs., 6th ser. mem., v. 20 (1890), p. 277–431 (in French). Abs., Eng. N., v. 25 (1891), p. 40–41.

Experiments on porosity and permeability of mortars of various composition. Results of seepage of soft and sea waters, and of long exposure to sea water in walls. Tabular data illustrated.

ALLEN, K. See TUTTLE, A. S., K. ALLEN, and W. T. CARPENTER. III.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. *Disintegration of Concrete and Corrosion of Reinforcing Metal*. A. Ry. E. & M. W. A. Bul., v. 15 (1914), No. 163, p. 564–568.

Discusses action of sea and alkali waters and protection of reinforcing.

— *Use of Concrete in Sea Water*. A. Ry. E. A. Bul., v. 22, No. 233 (1921), p. 546–549.

Report of committee on masonry. Conclusions and recommendations concerning the making and placing of plain and reinforced concrete sea-water structures.

ASSOCIATION RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS. *Action of Sea Water on Concrete*. Conc. Eng., v. 2 (1907), p. 139–140.

- Cem. Era, v. 5 (1907), p. 328. Abs., Chem. Abs., v. 2 (1908), p. 582.
- Committee report. Presents opinions and experiences of various engineers and observations by the committee. Special reference to frost action and methods of placing concrete.
- ATWOOD, W. G., and A. A. JOHNSON. *Disintegration of Cement in Sea Water*. A. S. C. E. Proc., v. 49, Aug., 1923, p. 1038-1064.
- Ancient structures, later scientific developments, results secured by foreign investigators, the use of puzzolan additions in the United States, "alca" cement, conclusions. Bibliography. Discussions September, October, November, and December, 1923, by the following: B. B. Jeanneret, A. H. Rhett, I. Hirol, Theodore Belzner, N. C. Johnson, W. M. Black, A. D. Flinn, B. A. Howes, T. H. Wiggins, Robert Ridgway, R. H. Gaines, J. R. Slattery, Kenneth Allen, J. C. Riedel, C. R. Harte, Chandler Davis, A. H. White, E. G. Walker, E. F. Cykler, Albert Moyer, J. Y. Jewett, Richard Grun, J. O. Draffin, C. A. Newhall, E. de Castro, and R. Feret.
- BAFFREY, R. *Use of Reinforced Concrete in Sea Water*. N. A. Cem. Users Proc., v. 7 (1911), p. 383-400.
- General discussion with numerous descriptions of successful and unsuccessful cases. Discussions. Illustrated.
- BAKENHUS, R. E. *Action of Sea Water on Concrete Specimens at Boston Navy Yard*. Eng. & Contr. v. 47 (1917), p. 74-75.
- A short description of tests on reinforced concrete piers in sea water, by Aberthaw Construction Co., at Charlestown (Mass.) Navy Yard. Tables showing scheme of tests and results up to January, 1916. (For full report to 1920, see Aberthaw Construction Co.)
- BAKENHUS, R. E., et al. *Tests of Concrete Specimens in Sea Water at Boston Navy Yard*. A. S. C. E. Trans., v. 81 (1917), p. 645-708.
- A complete and detailed description of the tests up to January, 1916, on reinforced concrete piers in sea water made at Charlestown (Mass.) Navy Yard by Aberthaw Construction Co. Includes, mostly in tabular form, all physical and chemical tests of concrete materials and sea water; full account, with contract and specifications, of manufacture, curing and testing of specimens; detailed description of progressive results to date and classification of specimens with respect to durability as affected by the nature and proportions of ingredients. One illustration. Discussions by various engineers citing practical related experience and describing similar tests, with tabulations and illustrations. For 1920 results, see "Aberthaw Construction Company."
- BARKER, R. See VI.
- BARTHOLOMEW, T. *Destruction of Concrete by Sea and Alkali Water*. Mining Science, v. 62 (1910), p. 206.
- Reviews some current opinions and notes, some points to be observed in preventing action and examining damage.
- BATES, P. H., and others. See II.
- BAUCHERE, A. *Tests of Decomposition of Cement Mortars by Sea Water and Waters Containing Sulphates*. Int. A. T. M. Non-Off. Papers (1906), B4, f. and e, 4 p. (French. Abs. in English).
- Laboratory tests on mortars of various composition in sea and sulphate waters. Tabular data. Results and conclusions.
- BAYKOFF, A. See CZARNOMSKI, W., and A. BAYKOFF, III.
- BELLOTTÉ. *Examination of Slag Cements for Sea Water Purposes*. Ton. Zeit., v. 34, p. 64.
- BIED, J. *Experiments on Decomposition of Mortars by Sulphate Waters*. Int. A. T. M. Proc., 5th Cong. (1909) Paper XI-1, 10 p. Ton. Zeit., v. 33, (1909), p. 1227.
- Description of laboratory tests covering six years of action of sulphate solutions and artificial sea water on mortars with admixtures of artificial puzzolan. Results and deductions. Illustrated.
- *Sea Water and Concrete*. Ann des. P. et Chs. (1902), III, p. 95.
- BLEININGER, A. V. See II.
- BLOQC, V. I. P. de. *Effect of Sea Water on Reinforced Concrete*. Eng. Rec., v. 66 (1912), p. 269. Abs. Chem. Abs., v. 6 (1912), p. 2988.
- Precautions in making concrete to render it sea-proof.
- BLOUNT, B. *Probable and Presumptive Life of Concrete Structures Made from Modern Cements*. Int. Eng. Cong. Trans. (1915), v. 5, p. 223-240. Abs. Chem. Abs., v. 9 (1915), p. 3345. Abs. Can. Eng., v. 31 (1916), p. 15.
- General discussion of causes of concrete failures. Special reference to sea water, salt solutions, acids, and electrolysis. Suggestions for preventative measures.
- BOYDEN, H. C. *Concrete for Salt Water Works*. Engineer, v. 131 (1921), p. 384.
- Discusses impermeability of concrete as a preventative of deterioration and suggests methods of securing it.
- BROWN, H. P. See VI.
- BURCHARTZ, H. See VI.
- BURCHARTZ, H., and J. V. WROCHEM. See VI.
- BURR, E. *Preservation of Reinforced Concrete in Sea Water*. Can. Eng., v. 23 (1912), p. 349-352. Abs. Chem. Abs., v. 6 (1912), p. 2988.
- General discussion, suggestions, and current opinions.
- CANDLOT, E. *Influence of Sea Water on Mortars*. Eng. Rec., v. 36 (1897), p. 557-558.
- Reviews results and conclusions of 40 years of investigation in France by various engineers.
- *Materials Capable of Resisting Sea Water*.
- Paper delivered at meeting of the French and Belgian members of the International Association of the Materials of Construction April 25, 1903.
- CAREY, A. See KYLE, J., and A. CAREY. VI.
- CAREY, A. E. *Carey on Portland Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 107 (1891-92), p. 57, 60, 69.
- Short discussion of action of sea water on concrete and results of experiments on gauging with sea water and exposure to it. Tabular data.

- CARPENTER, W. T. See TUTTLE, A. S., K. ALLEN and W. T. CARPENTER. III.
- CAY, W. D. *Durability of Portland Cement in Sea Water*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 100 (1889-90), p. 85-88.
Discusses tests on various cements in sea water by Vicat and Durand, Claye and Debray.
- . *Strength of Briquettes when Made with Fresh and Salt Water*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 62 (1879-80), p. 212.
Table showing comparative strengths in 7, 14, and 28 day tests.
- CHAPMAN, C. M. *Results of Experiments upon Effect of Sea Water on Tensile Strength of Various Mixtures of Cement and Sand*. N. A. Cem. Users Proc., v. 6 (1910), p. 172-179. Eng. Rec., v. 61 (1910), p. 311.
Description of tests on briquettes. Diagrams of results. Discussion.
- CHENOWETH, A. C. See VI.
- CLARKE, E. C. *Experiment No. 8*. A. S. C. E. Trans., v. 14 (1885), p. 155.
Tests on mortar briquette made with and immersed in salt and fresh waters.
- COIGNET, *Action of the Sea*. A. S. C. E. Trans., v. 1 (1868-1871), p. 110-115.
Describes sea water tests on concrete blocks of various compositions. Results and conclusions.
- COLLIER, B. C. See VI.
- CRARY, A. P. *Some Experiences with Concrete in the Republic of Panama*. Eng. N., v. 73 (1915), p. 214-216.
Describes construction and disintegration of concrete wharves at Panama City. Diagrams. Illustrated.
- CZARNOMSKI, W. *On the State of Preservation of Test Blocks and Blocks Proceeding from the Harbor Works, Immersed in the Baltic Sea at Libon Harbor*. Int. A. T. M. Proc., v. 2 (1912), Paper No. 8, 19 p. Abs., Eng. Rec., v. 66 (1912), p. 329.
Chemical tests on fragments of masonry and concrete blocks after 8 to 14 years immersion. Tabular data. Illustrated.
- CZARNOMSKI, W. and A. BAYKOFF. *On the Conditions of the Cement Blocks in Some of the Russian Ports in the Black and Caspian Seas*. Int. A. T. M., 5th Cong. (1909), Paper No. XI₂ and Suppl. to Cong. Doc. Int. A. T. M. Proc. (1908-1910), v. 1, No. XI₂. Int. A. T. M. (1906), Non-Off. Papers, B. 7f.
- DAVIS, C. *Concrete for Maritime Structures*. N. A. Cem. Users. Proc., v. 6 (1910), p. 120-156. Abs., Concrete, v. 5 (1910), No. 6, p. 35-42. Exten. Abs., Eng. & Contr., v. 34 (1910), p. 180-185.
Discussion of past and present design and methods of construction of quay walls, docks, etc. Numerous descriptions and diagrams of such works. Illustrated.
- DEBRAY, P. See DURAND-CLAYE, L., and P. DEBRAY. III.
- DEFORGE. See LOMBARD and DEFORGE, III.
- DODWELL, C. E. W. *Effect of Sea Water on Concrete Structures*. Can. Eng., v. 39 (1920), p. 279-280. Eng. & Contr., v. 54 (1920), p. 281-282.
Discusses deterioration of concrete piers in sea water at Annapolis Royal, Nova Scotia, after 3½ and 5 years exposure. Illustrated.
- D'ROHAN, W. *The Effect of Sea Water, Alkali Water, and Sewage on Portland Cement and Methods for Counteracting same*. Eng. & Contr., v. 34 (1910), p. 52-55 (Ed. comment, p. 45).
General discussion and opinions of various engineers.
See also VI.
- DURAND-CLAYE, L., and P. DEBRAY. *Portland Cement Mortars and their Decomposition by Sea Water*. Engineer, v. 66 (1888), p. 386.
Results of analyses of mortars after action by sea water, and permeability tests of unexposed parts of docks. Also comparative tests of magnesium sulphates and chlorides acting on mortars. Tabular data.
- DYCKERHOFF, —. *Action of Sea Water on Portland Cement*. Chem. Zeit., v. 34, p. 419.
- DYCKERHOFF, R. *Effect of Included Sulphuric Acid on the Strength of Portland Cement Exposed to Sea Water*. Eng. N., v. 64 (1910), p. 4-5. Abs., Chem. Abs., v. 5 (1911), p. 581. Disc., Ton. Zeit., v. 33, p. 1234. Disc., Abs., Chem. Abs., v. 3 (1909), p. 2866, and v. 5 (1911), p. 2316. Disc., Cem. Age, v. 11 (1910), p. 118.
Results of German tests. Tabular data.
- DYER, A. F. *The Use of Reinforced Concrete in Marine Works*. Eng. & Contr., v. 50 (1918), p. 483-485.
Describes various structures in different parts of the world.
- ENDELL, K. See IV.
- EVERETT, H. A. *Fallacy of Concrete Ships*. Int. Marine Eng., v. 23 (1918), p. 61-62.
Challenges claims of superiority for concrete ships and discusses comparative merits. Reference to deteriorating action of sea water.
- FAIJA, H. *Effect of Sea Water on Portland Cement*. London Society of Engineers. Trans., 1888, p. 49-62.
Discusses damage to Aberdeen graving-dock and tests tending to show that properly mixed and set concrete is durable in sea water. Extensive discussion.
- FERET, R. *Effect of Sea Water on Concrete*. Ann. des P. et Chs. (1890), I, p. 375. Ibid. (1892), II, p. 93, 106-116. Ibid. (1901), IV, p. 191. Ibid. (1907), I, p. 107.

FERET, R. *Effect of Sea Water upon Concrete and Mortar*. "Concrete; Plain and Reinforced" by Taylor & Thompson (1911 edition), p. 309-318.

Discusses chemical processes and causes of deterioration. Suggestions concerning cements and aggregates for use in concrete subject to sea water action.

FERGUSON, L. R. See WIG, R. J., and L. R. FERGUSON, III. TOCH BROS., R. J. WIG., and L. R. FERGUSON, III.

FRAMM, F. See VI.

FRASER, O. See VI.

GARY, M. See POULSEN, A., M. GARY, and C. SCHNEIDER, III. GARY, M., IV and VI.

GARY, M., and C. SCHNEIDER. *First Report on Behavior of Cements in Sea Water*. Mittheilungen aus den Koniglichen Technischen Versuchsaustalten zu Berlin, 1900, supplement, p. 1-47.

Second Report on the Behavior of Cements in Sea Water. Mitt. Kgl. Matpr., v. 27 (1909), p. 229-317. Abs., Chem. Abs., v. 4 (1910), p. 655.

Reports tests of action of sea water on concretes of high and low lime cement. Covers five-year tests.

GASSIER. See VI.

GOFFETTE, J. L. *Formula for Making Lime Products*. Cem. & Eng. N., v. 33 (1921), No. 12, p. 18.

Author desires to sell or lease formulæ for making cements proof against sea water alkali and atmospheric action.

GOSLICH, C. *Report of the Sea Water Commission of the German Association of Portland Cement Manufacturers*. Ciment, v. 17, p. 66. Chem. Zeit., v. 36, p. 453. Abs., Chem. Abs., v. 6 (1912), p. 1831.

GREENMAN, R. S. See IV.

GRUN, R. *Process of Making Salt-Water-Proof Concrete Structures from Portland, Iron Portland, Blast Furnace, or Puzzolan Concrete*. Zeitschrift Kali, v. 17, p. 108.

GUERITTE, T. J. *Ferro-Concrete Ships*. Engineering, v. 105 (1918), p. 295-297.

General discussion of materials, methods of construction, durability, and cost. Reference to requirements of concrete used and lasting qualities of vessels.

HAMBLOCH, I. A. See VI.

HARRISON, J. L. *Concrete in Sea Water*. Concrete, v. 15 (1919), p. 198-200.

Discusses nature of action and deductions from investigations made in Philippine Islands. Considers impermeability of highest importance. Illustrated.

HARRISON, J. L. *Effect of Sea Water on Some of the Concrete Structures in the Philippine Islands*. Eng. & Contr., v. 47 (1917), p. 580-582.

Describes disintegration in several sea-water concrete structures. Tabular data. Illustrated.

Effect of the Use of Salt Water for Gaging Concrete on the Life of the Reinforcing Steel Imbedded Therein. Bureau of Public Works, Philippine Isl., Quarterly Bul., v. 5 (1916), No. 2, p. 19-22. Eng. & Contr., v. 46 (1916), p. 443-446. Concrete, v. 10 (1917), p. 110-112. Eng. N., v. 76 (1916), p. 1047. Balt. Eng. Club Jour., v. 6 (1916-17), December.

Discussion of damaging effects as investigated in the Philippine Islands, and deductions therefrom. Illustrated.

Limestone Aggregate in Sea Water. Concrete, v. 11 (1917), p. 88.

Notes failure of wharf in Philippine Islands constructed of concrete with coral aggregate.

Steel in Concrete Construction in Sea Water. Concrete, v. 15 (1919), p. 236-239. Exc., Eng. & Contr., v. 53 (1920), p. 94-95.

Describes corrosion of steel in Philippine Island structures; discusses possible causes and makes deductions from results of his investigations. Illustrated.

HIROI, I. See VI.

HODGDON, F. W. *Sea Water Disintegration at Boston*. Eng. Rec., v. 63 (1911), p. 655-656.

Describes deterioration of concrete structures in Boston Harbor.

HOLLISTER, S. C. *Behavior of Concrete Exposed to Sea Water*. A. S. T. M. Proc., v. 23 (1923), pt. 2, p. 202-204. Outline of the problem.

HOOL, G. A., and N. C. JOHNSON. *Durability of Cement Mortar and Concrete*. "Concrete Engineers' Handbook" (New York, 1918), p. 256-259.

Review of opinions on action on concrete of sea water, alkalies, oils, acids, sewage, and electrolysis.

HORTON, C. C. *Efficiency and Cost of Concrete for the Preservation of Piles Exposed to Sea Water*. N. A. Cem. Users Proc., v. 6 (1910), p. 169-171. Short discussion of various methods and some cost data.

HOUGH, N. G. *Hydrated Lime in Boston Navy Yard Concrete Specimen*. Eng. & Contr., v. 47 (1917), p. 199.

Objects to conclusions regarding hydrated lime in Aberthaw concrete-sea water tests.

See Aberthaw Construction Company, III.

Hydrated Lime not Fairly Treated in Boston Sea Water Tests. Eng. N. Rec., v. 80 (1918), p. 575.

Criticizes conclusions regarding hydrated lime in Aberthaw tests of concrete in sea water.

See also Aberthaw Construction Company, III.

HOWKINS, J. D. *Deterioration of Concrete*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 188 (1911-12), p. 416.

Discusses failure of concrete in British pier as due to submarine springs of gypsiferous water.

HUBER, F. W. *Factors Controlling the Durability of Concrete in Sea Water*. Western Engineering, v. 5 (1914-15), p. 197 (9½ col.).

Discusses chemical action and methods of preventing disintegration. Notes various structures and failures. Describes various tests and conclusions.

HUMPHREY, R. L. *Chemical Laboratory*. (U. S. G. S. Tests). A. S. T. M. Proc., v. 10 (1910), p. 639-640.

Short review of tests on concrete exposed to sea water and alkali water and on waterproofing compounds. 1909-10.

HUMPHREY, R. L., and J. S. SEWELL. *Application of Reinforced Concrete to Hydraulic Works*. Permanent Int. Ass'n. of Navigation Congresses, 12th Cong. (1912), Reports Nos. 30 and 28. Abs. Eng. N., v. 67 (1912), p. 1029-1031. Disc., Eng. N., v. 68 (1912), p. 29.

General discussion of reinforced concrete as used in harbor and inland works in United States of America, including a study of destructive agencies. Illustrated.

INSTITUTION OF CIVIL ENGINEERS (LONDON). *Deterioration of Structures in Sea Water*. 1st Report of Committee (1920), 279 p. Disc. Conc. & Const. Eng., v. 15 (1920), p. 392. Abs. Contract Rec., v. 34 (1920), p. 585. Abs. Concrete, v. 17 (1920), Mill Sect., p. 57. Abs. Eng. & Contr., v. 53 (1920), p. 733. Abs. Engineering, v. 109 (1920), p. 584.

General report on deterioration of structural materials in sea water. Numerous descriptions of concrete sea water works with discussion on effects of destructive agencies and remedial suggestions. Excellent diagrams and illustrations.

INSTITUTION OF CIVIL ENGINEERS (LONDON).—COMMITTEE TO INVESTIGATE THE DETERIORATION OF STRUCTURES OF TIMBER, METAL, AND CONCRETE EXPOSED TO THE ACTION OF SEA WATER. *Second (Interim) Report*, edited by P. M. Crosswaite and R. S. Redgrave (1922) 57 p.

JOHNSON, A. A. See ATWOOD, W. G., and A. A. JOHNSON, III.

JOHNSON, N. C. *Mechanical Features of Hydration of Portland Cement and Making of Concrete*. A. S. M. E. Jour., v. 37 (1915), p. 516-525.

Microscopic study of structural processes in the setting of cement. Special reference to action of sea water on concrete. Discussions. Illustrated.

—. *Old Treatise Emphasized Same Points*. Eng. N. Rec., v. 80 (1918), p. 264, 267.

Quotes old works on concrete which state some of conclusions of Wig and Ferguson in series of five articles on concrete in sea water. For author's reply see Wig, R. J., and L. R. Ferguson, III.

JOINT COMMITTEE (ENGINEERING SOCIETIES). *Final Report of the Special Committee on Concrete and Reinforced Concrete*, Chaps. I. to VI. A. S. C. E. Trans., v. 81 (1917), p. 1101-1123. A. S. T. M. Proc., v. 17 (1917), p. 202. A. Ry. E. A. Proc., v. 18 (1917), part 2, p. 1. Am. Conc. Inst. Proc., v. 13 (1917), p. 509. Concrete, v. 10 and 11 (1917), (Pub. serially.)

Includes recommendations concerning destructive agencies and materials, methods of mixing, placing and construction to insure durability.

KASAI, S. See VI.

KELLEY, W. F., and R. PICKWELL. *Alexandria Graving Dock, Belfast. Construction of a Concrete Graving Dock at Newport, Mon.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 111 (1892-93), p. 75-128.

Two papers with extensive discussion and correspondence. Discuss the construction, maintenance and behavior of these docks, with results of inspections, opinions, and experiences of many engineers with respect to durability of concrete structures in sea water.

KINIPPLE, W. R., J. KYLE, and others. *Concrete Work for Harbors*. ("Concrete Work Under Water," "Columbo Harbor Works, Ceylon,"). Inst. Civil Eng. (Lond.) Min. & Proc., v. 87 (1886-87), p. 65-240.

Six papers on concrete harbor works in various parts of the world, with extensive discussion and correspondence concerning them. Includes much detail as to design and structural methods, with opinions, observations and experiences of many engineers. Tabular data of cement tests, etc.

KLAUDY, J. See VI.

KYLE, J. See KINIPPLE, W. R., J. KYLE and others, III.

KYLE, J., and A. CAREY. See VI.

LECHATELIER, H. *Behavior of Cements in Sea Water*. Conc. & Const. Eng., v. 2 (1907), p. 112-117.

Discusses chemical and physical aspects of decomposition. Special reference to porosity and the formation of impermeable coatings.

—. *Causes of Destruction of Hydraulic Mortars*. "Experimental Researches in the Constitution of Hydrated Cements" (New York, 1905), p. 111-120.

Study of the disintegrating actions of air, fresh water, and sea water.

—. *Decomposition of Cement by Water*. Chem.-Zeit., v. 15, p. 451.

—. *Decomposition of Cements*. Proceedings 7th Int. Congress Applied Chemistry (London, 1909), sec. 2, p. 10-15 (in French). Abs., Chem. Abs., v. 5 (1911), p. 1829.

Describes results of laboratory tests in various cements with calcium sulphate, magnesium sulphate, and artificial sea water.

LECHATELIER, H. *Decomposition of Cements in Sea Water*. Int. A. T. M. Off. Rpts. (1906), Paper 31e, 16 p. Abs., Chem. Abs., v. 1 (1907), p. 92-93. Exc., Eng. N., v. 56 (1906), p. 377. Exc., Ton. Zeit., v. 33, p. 931.

Discusses from chemical viewpoint causes and nature of disintegration of concrete in sea water.

———. *Mechanism of Decomposition of Hydraulic Mortars*. Soc. d'Encour. l'Ind. Nat. Bul. (1899), p. 480.

———. *Search for Materials Capable of Resisting Sea Water*. Annales des Mines (May and June, 1887). Ibid., 8th Series, v. 11. Congres International des Materiaux de Construction held at Paris, 1900, vol. II, part 2.

LJAMIR. See VI.

LOMBARD AND DEFORGE. *Report on Tests at the tour St. Nicholas on Concrete in Sea Water*. La Rochelle Laboratory (France), July 1, 1911.

LUIGGI, L. See VI.

MACKENZIE, W. B. *Disintegration of Concrete Exposed to Sea Water Between High and Low Tides*. Eng. N., v. 58 (1907), p. 472. Abs., Chem. Abs., v. 2 (1908), p. 172.

Describes action of sea water on concrete structures in Canada. Editorial comment.

MARKUS, O. See IV.

MATHEWS, E. R. *Action of Sea and Fresh Water on Cement and Concrete*. Surveyor, v. 35 (1909), p. 350-352. Engineering Digest, v. 5 (1909), p. 527-528. Abs., Chem. Abs., v. 3 (1909), p. 1676.

Discusses tests, results, and conclusions regarding action on neat cement and concrete of sea and fresh water when used in mixing and as a curing medium. Protective measures against destructive action of sea water. Opinions of authorities to date. Tabular data.

———. *Flood Prevention Works at Troon, Ayrshire, and the Action of Sea Water on Concrete*. Surveyor, v. 57 (1920), p. 329-332. Society of Engineers (London), Jour. & Trans., v. 11 (1920), p. 75-107. Eng. & Contr., v. 53 (1920), p. 739.

Design and construction of concrete sea wall and connected works. Describes compressive strength tests on concrete of various aggregates and on specimens mixed with sea water and exposed to air, tidal conditions, and immersion in sea water. Tabular data and diagrams.

———. *Notes on the Deterioration of Structures in Sea Water*. Conc. & Const. Eng., v. 15 (1920), p. 392-395. Abs., Chem. Abs., v. 14 (1920), p. 2695.

Discussion of the committee report on this subject (see Institution of Civil Engineers (London), III), with critical suggestions and original conclusions.

MAYER, E. *Report on Trials Made at La Rochelle on the Action of Sea Water on Mortar*. Int. A. T. M. Non-Off. Papers (1906), Papers B6, f, and e, 105 p. (in French). Abs., Cem. Age, v. 4 (1907), p. 169-172. Abs., Chem. Abs., v. 1 (1907), p. 1612-1615.

Results and conclusions of long-time tests of blocks in sea. Extended tabular data.

MAYNARD. *Solution and Decomposition of Cements*. Ton. Zeit., v. 33 (1909), p. 1462. Abs., Chem. Abs., v. 4 (1910), p. 372.

Results of 2 1/2 year tests to determine effects of distilled and sea waters on cement.

See also VI.

MEADE, R. K. *Portland Cement and its Resistance to Sea Water*. Concrete, v. 8 (1908), No. 4, p. 25.

Discusses alumina content of cement in relation to resistance to sea water.

See also II.

MEYER, A. *Effect of Sea Water upon Cements*. Soc. Chem. Ind. Jour., v. 22 (1903), p. 29. Chemisches Centralblatt, Jahrg. 73 (1902), v. 2, p. 1368.

Discusses chemical action.

MICHAELIS, W. *Behavior of Portland Cement in Sea Water*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 107 (1891-92), p. 370-376. Exc., "Concrete and Reinforced Concrete Construction," by H. A. Reid (New York, 1907), p. 152.

Technical discussion of the physical and chemical aspects. Recommendations as to composition and methods of making sea-resistant concrete. Tabular data.

———. *Resistance of Cement to Sea Water*. Soc. d'Encour. l'Ind. Nat. Bul. (1897), p. 818.

See also VI.

MICHAELIS, W., Jr. See VI.

MOLLER, M. *Use of Reinforced Concrete Beside the Sea*. Int. A. T. M. Proc., 5th Cong. (1909), Paper XI₃, 3 p.

Thirteen-year tests on reinforced concrete, both preured and produced in situ, exposed to tidal action. Results and conclusions.

MONCRIEFF, J. M. *Discussion on White Star Dock at Southampton*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 195 (1913-14), p. 78.

Describes increase in size in sea-water dock during 22 years.

MURALT, M. DE. *Remarks Concerning the Effect of Sea Water on Reinforced Concrete*. Cement, v. 13 (1912), p. 124-126. Abs., Chem. Abs., v. 7 (1913), p. 1087.

General discussion of sea-water action and the composition, making and placing of concrete to resist it. Reference to specific cases and tests.

NEWBERRY, S. B. See VI.

NITZSCHE, H. See II.

- O'HARA, J. M. *Action of Sea Water on Portland Cement*. Eng. Rec., v. 61 (1910), p. 677-678. Cem. & Eng. N., v. 22, p. 288-290. Ex. Abs., Chem., Abs. v. 4 (1910), p. 2562. Disc., Eng. Rec., v. 61 (1910), p. 741. Discusses accelerated tests on cement and mortar specimens in sea water; also normal 12-month tests. Tables and diagram of results.
- OWENS, J. S. *Attrition of Concrete Surfaces by Sea Action*. Eng. & Contr., v. 53 (1920), p. 356-357. Discusses physical aspects of wear of concrete structures located on ocean foreshores. Suggests preventative measures.
- OWENS, J. S., and F. J. WOOD. *Reinforced Concrete Sea Defenses*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 189 (1911-12), p. 292-309. Ex. Abs., Eng. N., v. 69 (1913), p. 668. Describes construction of reinforced groynes and sea walls on Sussex coast. Recommendations drawn from this experience are made concerning the design of such structures.
- PAGON, W. W. See VI.
- PATCH, DAN. *Water Content Affects Wear of Concrete Test Pieces*. Eng. N. Rec., v. 86 (1921), p. 373. Comments based on investigations of Abertaw Construction Co.
- PICKWELL, R. See KELLEY, W. F., and R. PICKWELL, III.
- POIRSON, L. *Effect of Sea Water on Cements*. Ciment, 1910, part 6-7. ——. *Studies of the Chemical Influence of Sea Water upon Portland Cement*. Zentralblatt Hydraulische Zemente (translation from Ciment, 1910, Nos. 6 and 7). Abs., Chem. Abs., v. 5 (1911), p. 1328.
- POPE, A. *Concrete Wharf Exposed to Sea Water and Wave Action at Fort Williams, Me.* Prof. Mem., v. 8 (1916), p. 676-682. Describes construction, exposure, disintegration, and repair of wharf.
- POTTER, C. J. See VI.
- POULSEN, A. See VI.
- POULSEN, A., M. GARY and C. SCHNEIDER. *Influence of Sea Water on Cement and Concrete*. Conc. & Const. Eng., v. 5 (1910), p. 23-29. Eng. & Contr., v. 34 (1910), p. 51. Eng. N., v. 64 (1910), p. 3-4. Int. A. T. M. Proc., 5th Cong. (1909), Paper XI₄, Inst. Civil Eng. (Lond.) Min. & Proc., v. 193 (1912-13), Part III, p. 373. Cem. Age, v. 10 (1910), p. 184, 260. Describes 10-year Scandinavian and German tests of mortar and concrete blocks in sea water. Results and conclusions regarding cements, aggregates, and admixtures as affecting durability. Illustrated.
- PRICE, W. H. *Manora Breakwater, Kurrachee*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 43 (1875-76), p. 1-21. Discusses construction, maintenance, behavior, and repair of concrete breakwater of pre-set blocks with parts of foundation cast in situ. Extensive discussions.
- RAVIER, L. See VI.
- REBUFFAT. *Action of Sea Water on Cement*. Gazzetta Chimica Italiana, v. 31, p. 155. Chemisches Zentralblatt (1901), p. 927. ——. *True Formula of Calcium Sulpho-Aluminate*. Gazzetta Chimica Italiana, v. 32, p. 158.
- RHETT, A. H. *Porosity the Vital Point to Consider*. Eng. N. Rec., v. 80 (1918), p. 265, 267. Questions importance attached to carbonate of lime skin and abrasion by Wig and Ferguson in second of five articles on concrete in sea water. Suggests porosity as more important. Authors' reply. (See WIG, R. J., and L. R. FERGUSON, III.)
- ROCHEMONT, E. T. Q. de. *On Portland Cement Employed in the Works at Port of Haire Since 1870*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 107 (1891-92), p. 377-389. Results of tensile and compressive strength tests, covering 17 years, on cement briquettes gauged with and exposed to sea water. Effects of storage of cement. Tables and diagrams.
- RODT, V. See IV.
- SARTORI, A. See II.
- SAVILLE, C. M. *Action of Sea Water on Concrete Blocks, Cristobal, Canal Zone*. Harvard Eng. Jour., v. 9 (1911), p. 197-213. Abs., Chem. Abs., v. 5 (1911), p. 2421. Description of concrete blocks after 25 years' exposure to sea-wave action. Specifications under which blocks were made. Tabular data illustrated.
- SAVILLE, L. H. *Reasons for the Deterioration of Reinforced Concrete Structures Above Mean Tide Level*. Engineering, v. 112 (1921), p. 73-74; Discussion, p. 40-42. ——. *Reinforced Concrete in Sea Water Structures*. Can. Eng., v. 44 (1923), p. 162. Reference to second (interim) report of committee of the Institute of Civil Engineers on "Deterioration of structures exposed to sea water."
- SCHNEIDER, C. See GARY, M., and C. SCHNEIDER, III. POULSEN, A., M. GARY, and C. SCHNEIDER, III.
- SCHOTT, O. *American Portland Cement Concrete in Sea Water*. Chem. Zeit., v. 35, p. 276.
- SCHULJATSCHENKO. *Action of Sea Water on Portland Cement*. Ton. Zeit., v. 23, p. 917. ——. *Destruction of Cements by Sea Water*. Cement, v. 2 (1901), p. 291.
- SCHWARTZ. See VI.
- SEWELL, J. S. See HUMPHREY, R. L., and J. S. SEWELL, III.
- SHAW, A. L. See VI.

SHERTZER, T. B. *Further Examples of the Injury of Concrete Subject to Tidal Influence.* Eng. N., v. 60 (1908), p. 453. Abs. Chem. Abs., v. 3. (1909), p. 479. Abs. Cem. Age, v. 8 (1909), p. 53.

Discusses disintegration of concrete sea structures in Maine and New York. Describes tests on laboratory specimens made to ascertain cause.

SMITH, W. *Influence of Sea Water upon Portland Cement, Mortar and Concrete.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 107 (1891-92), p. 73-198.

Description of investigation of concrete work at Aberdeen Harbor and general discussion of chemical deterioration of concrete in sea water. Discussion and correspondence by numerous engineers with accounts of many other tests and observations. Much technical detail. Tabulated data. Remedial measures.

SNOW, W. A. *Pronounced Reinforcement Corrosion Due to Sea Water or Electrolysis.* Eng. N. Rec., v. 87 (1921), p. 528-529.

SPANISH SEA-WATER COMMISSION. *Action of Sea Water on Cements.* Ann. des P. et Chs., v. 11 (1917), p. 253-254. Abs., Chem. Abs., v. 12 (1918), p. 617.

Discusses causes and nature of action and offers recommendations for preventing.

SPACKMAN, H. S. *Alumina-Cement—Its Development, Use and Manufacture.* Eng. N. Rec., v. 88 (1922), p. 831-834. Cem. & Eng. N., v. 34 (1922), p. 18-20.

Discusses alumina cement as used in France. Much greater resistance to sea water.

See also II.

SPREGELBURG. See II.

SQUIRE, H. E. *Some Observations on Concrete in Sea Water in San Francisco Harbor.* Eng. N. Rec., v. 80 (1918), p. 575-577.

Questions certain of Wig and Ferguson's conclusions regarding failure of concrete in sea water. Discusses relative values of calcium carbonate skin and density as protection. Also causes of reinforcement corrosion.

(See WIG, R. J., and L. R. FERGUSON, III.).

STANIFORD, C. W. *Tensile Tests of Cement Briquettes Exposed to Fresh River and Artificial Sea Water.* Eng. N., v. 67 (1912), p. 892. Abs., Chem. Abs., v. 6 (1912), p. 1830.

Tests covering one year with several brands of cement. Diagrams.

TAFT, H. S. *Reinforced Concrete Docks.* A. S. C. E. Trans., v. 78 (1915), p. 1058-1111.

Review of foreign and American practice in reinforced concrete dock construction, failures and causes, opinions of experts and general conclusions. Considers initial cost and repairs. Discussions.

See also VI.

THATCHER, E. *Effect of Sea Water Upon Portland Cement, Mortar and Concrete, and Upon Steel Embedded*

Therein. A. S. C. E. Trans., v. 61 (1908), p. 42-45. Cement, v. 8 (1908), p. 472-474. Abs., Chem. Abs., v. 2 (1908), p. 2007.

Review of current opinions and experiences of various American and European engineers of note.

TOCH, M. See IV.

TOCH BROTHERS, R. J. WIG, and L. R. FERGUSON. *Does Waterproofed Concrete Resist Sea Water?* Eng. N. Rec., v. 79 (1917), p. 1212-1213.

Exceptions taken to conclusions of Wig and Ferguson on effect of waterproofing compounds. Reply.

TUTTLE, A. S. *Use of Reinforced Concrete in or Near Sea Water.* Eng. & Contr., v. 56 (1921), p. 487-488.

Summary of rules for securing durable work.

TUTTLE, A. S., K. ALLEN, and W. T. CARPENTER. *Report on the use of Concrete in or near Sea Water.* N. Y. (City) Pub. Impr. Div. Rpt. (1921), 22 p. Abs., Eng. & Contr., v. 56 (1921), p. 487.

Reports conditions of Coney Island bathhouse. Experience, opinions, and suggestions of many engineers and concrete authorities on use of concrete in sea water. Chemical action discussed.

TUTTLE, M. C. *Concrete Test Specimens in Sea Water at Charlestown Navy Yard.* Eng. Rec., v. 64 (1911) p. 229.

1911 progress report on Aberthaw Construction tests of reinforced concrete piers in sea water at Charlestown. Tabulated data. Illustrated.

U. S. NAVY (Joint experimenters with Aberthaw Construction Co.) See ABERTHAW CONSTRUCTION CO., III.

VAN DER KLOES, J. A. *Action of Sea Water on Concrete.* De Ingenieur (The Hague), (1910), v. 25, p. 271-273.

VIENNOT. *Effect of Sea Water on Mortars.* Ton. Zeit., v. 21, p. 128.

WASON, L. C. *Tests of Concrete in Sea Water.* Eng. & Contr., v. 58 (1922), p. 293-295. Concrete, v. 21 (1922), p. 151-153. A. S. C. E. Trans. v. 86 (1923), p. 447-454; Discussion, p. 455-469.

Results of observations of piers in Boston Harbor.

WELLER, J. L. *Sea Water Concrete not Hopeless.* Eng. N. Rec., v. 80 (1918), p. 264, 267.

Questions conclusions in series of five articles by R. J. Wig and L. R. Ferguson on concrete in sea water. Author's reply.

(See WIG, R. J. and L. R. FERGUSON III.)

WENTWORTH-SHEILDS, F. E. *Best Way of Protecting Reinforced Concrete from Marine Deterioration.* Engineering, v. 112 (1921), p. 73.

Results of 20 years' experience and observation.

WIG, R. J., and L. R. FERGUSON. *Reinforced Concrete Failing*. A. S. T. M. Proc., v. 17 (1917), part 1, p. 290-299.

Discusses causes and nature of failure in sea water and suggests preventative measures. Notes effect on concrete of acids and alkalies and difficulty of prevention.

Series of five articles on *Concrete in Sea Water*. Eng. N. Rec., v. 79 (1917), p. 532, 641, 689, 737, 794. Disc., Eng. N. Rec., v. 80 (1918), p. 264-267, 575-576, 926.

Covers investigation which included personal examination of nearly every concrete structure in sea water in continental United States and many in Canada and Cuba, together with detailed information secured through American Consular officers regarding concrete structures in harbors in all parts of the world. (Compare with articles by HARRISON, J. L., III.)

1. *What is the trouble with Concrete in Sea Waters*. Eng. N. Rec., v. 79 (1917), p. 531, 532-535.

Introductory. Describes purpose, extent, and scope of investigation. Descriptive list of structures examined. Illustrations and map. Preceded by short editorial comment.

2. *Plain Concrete in Sea Water must be Protected*. Eng. N. Rec., v. 79 (1917), p. 641-645.

Discusses causes and nature of damage to plain concrete in sea water and precautions for preventing. Description of and comments on numerous observed failures. Well illustrated.

3. *Reinforced Concrete in Sea Water Falls from Corroded Steel*. Eng. N. Rec., v. 79 (1917), p. 689-693.

Discusses causes and nature of damage to reinforced concrete in sea water and preventative measures. Comments on specific observed cases. Illustrated.

4. *Selection of Materials for Sea Water Concrete*. Eng. N. Rec., v. 79 (1917), p. 737-741. Disc., Eng. N. Rec., v. 79 (1917), p. 1212.

Discusses effects of chemical constituents of cement, use of fresh and sea water, water-proofing compounds and various kinds of aggregate in making plain and reinforced concrete for sea-water structures. Numerous cases cited to verify conclusions. Illustrated.

5. *Good Workmanship necessary to make Sea Water Concrete Safe*. Eng. N. Rec., v. 79 (1917), p. 794-798.

Discusses necessity of reliable supervision and good workmanship in constructing sea-water concrete structures; proportioning of materials, quantity of water, care in mixing and placing concrete, construction joints, causes of failure, etc. General principles of successful construction. Cites verifying cases. Illustrated.

See also TOCH BROTHERS, R. J. WIG, and L. R. FERGUSON, III.

WIG, R. J., and others. See VI.

WILLIAMS, A. E. See VI.

WILLIAMS, T. S. *Concrete Wharf Supports in San Francisco Harbor*. Prof. Mem., v. 9 (1917), p. 393-398. Am. Port Auth. Proc. & Papers, v. 5 Paper No. 2 (1916). Can. Eng., v. 31 (1916), p. 347.

Describes making, placing, and theories of reinforced concrete piles and cylindrical supports and experience in their use in sea water.

WOOD, F. J. See OWENS, J. S., and F. J. WOOD, III.

WROCHEM, J. V. See BURCHARTZ, H., and J. V. WROCHEM, VI.

ZAMBONI. *Effect of Sea Water on Mortar Joints*. L'Industria, Oct. 15, 1899.

EDITORIALS, ANONYMOUS ARTICLES, ETC.:

Action of Sea Water on Concrete. Eng. & Contr., v. 55 (1921), p. 290.

Gives results of observations on piers immersed in sea water from 1909 to 1920.

Building Reinforced - Concrete Board Walk at Coney Island. Eng. N. Rec., v. 89 (1922), p. 229-230.

Rich concrete mix specified as protection against deterioration from sea water.

Calcium - Aluminum - Sulphate as a Destroyer of Concrete. See II.

Calcium - Aluminum - Sulphate; Effect on Concrete. See II.

Concrete Encased Steel at Kowloon, China. Inst. Civil Eng. (Lond.) Min. & Proc., v. 199, p. 133.

Decomposition of Concrete in Sea Water, an Example of. Eng. N., v. 60 (1908), p. 238. Abs., Chem. Abs., v. 2 (1908), p. 3400.

Describes disintegration of docks at Charlestown (Mass.) Navy Yard. Illustrated.

Deterioration of Materials Used in Harbour Construction. Engineering, v. 113 (1922), p. 739-740.

Eng. & Contr., v. 58 (1922), p. 270-272. Can. Eng., v. 43 (1922), p. 431-433.

Summary of second (interim) report of a committee of Institution of Civil Engineers in which is contained a general discussion of concrete in marine structures.

Disintegration of Concrete by Sea Water, Alkali, Sewage, etc., what Are the Facts Respecting? Eng. & Contr., v. 33 (1910), p. 539-540.

Editorial review of opinions and known facts, including 2½ column quotation from R. Hering on action of sewage.

Floating Oil as a Protection of Concrete from Action of Sea Water. Eng. & Contr., v. 55 (1921), p. 88.

Describes occurrences and effect of a thick tar-like substance on concrete piers of Aberthaw Construction Co.'s test on concrete in sea water at Charlestown (Mass.) Navy Yard. Deposits originated from floating fuel oil.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—Continued.

Heath Clay for Cement in Sea Water. See VI.

Impermeable Concrete for Marine Work, Notes on Methods for Securing. Eng. & Contr., v. 38 (1912), p. 201-202 (Ed. comment, p. 197).

Conclusions of three foreign engineers.

Intertidal Concrete in Sea Walls, Tile Protection for. Eng. N., v. 70 (1913), p. 1178-1179.

Describes patented facing wall of hollow glazed tile. Illustrated.

Investigation of Concrete Structures in Sea Water. Public Works of the Navy, Bul. 27 (1917), p. 40; Bul. 28 (1917), p. 20-47.

Observations at Boston, New York, Portsmouth, N. H., Mare Island, Calif. and Puget Sound Navy Yards. Contains tables and many illustrations.

Los Angeles Engineers Approve Concrete Sewer Pipe in Sea Water. Eng. N. Rec., v. 90 (1923), p. 825.

Results of inspection trip by Board of Public Works of Los Angeles.

Ocean Pier to be Scrapped Because of Concrete Disintegration. Eng. N. Rec., v. 84 (1920), p. 621-623. Abs., Chem. Abs., v. 14 (1919), p. 1746.

Disintegration of concrete of municipal pier, Santa Monica, Calif. Description of pier, its construction, and disintegration. Parts of condemnatory report by Board of Engineers. Illustrated.

Preservation of Steel Reinforcement in Concrete Structures. Eng. Rec., v. 57 (1908), p. 105.

Describes preserved condition of reinforced concrete building on New York beach.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—Continued.

Sea Water, Concrete in. Eng. N., v. 58 (1907), p. 461.

Three short general discussions.

Sea Water, Effect on Concrete. Concrete, v. 13 (1918), p. 35.

Short review of some Scandinavian and German tests. Protective measures in concrete shipbuilding.

Sea Water, More Observations on the Effect on Concrete. Eng. N. Rec., v. 86 (1921), p. 121-123. Abs., Chem. Abs., v. 15 (1921), p. 1063. Disc., Eng. N. Rec., v. 86 (1921), p. 652-653, 910.

Account of deterioration of concrete piers along southern California coast. Statement of conditions and general discussion. Illustrated. Also short discussion and tabulated statement of manufacture of and tests on concrete piers in sea water by Aberthaw Construction Co. at Charlestown (Mass.) Navy Yard.

Sea Water, Tests of the Effect on Concrete. Eng. N., v. 64 (1910), p. 319. Abs., Chem. Abs., v. 4 (1910), p. 3127.

Describes tests proposed at Panama Canal.

Sea Water, Tests on Concrete in. Eng. N., v. 64 (1910), p. 483. Abs., Chem. Abs., v. 5 (1911), p. 182.

Describes German tests using cements of various compositions. Summary of five-year results.

Tests on Sea Water Corrosion of Structural Materials. Eng. and Contr., v. 57 (1922), p. 530.

IV. OTHER INJURIOUS AGENTS

EFFECTS OF SEWAGE, ACIDS, OILS AND VARIOUS CHEMICALS ON MORTAR AND CONCRETE; MEASURES FOR PREVENTION

ABERTHAW CONSTRUCTION CO. See STONE and WEBSTER, ABERTHAW CONSTRUCTION Co., and others, IV.

ABRAMS, D. A. *Effect of Tannic Acid on Strength of Concrete.* Structural Mater. Research Lab., Lewis Inst. (Chicago), Bul. No. 7 (1920), 31 p. A. S. T. M. Proc., v. 20 (1920), Rpt. 1, p. 309-339. Exc., Ry. Age Gaz., v. 68 (1920), p. 1971. Exc., Eng. and Contr., v. 54 (1920), p. 277. Exc., Concrete, v. 17 (1920), p. 172. Exc. Pub. Wks., v. 50 (1921), p. 245.

Report on about 2,000 tests on concrete cylinders in the manufacture of which various amounts of commercial tannic acid were added to the sand. Full description of tests and results. Conclusions regarding effect on compressive strength with respect to percentage of acid, proportions of concrete materials, and age of specimens. Seven tables and 16 diagrams.

ALWAY, F. J. *Behavior of Cement Mortar and Concrete in Some German Bogs.* Am. Peat Soc. Jour. (April, 1923), p. 60-66.

Review of report of subcommittee of the German committee on reinforced concrete.

— *Disintegration of Cement Tile in Peat.* Am. Peat Soc. Jour., v. 15 (1922), No. 3, p. 15-25.

Relates particularly to European conditions.

AMERICAN SOCIETY OF SANITARY ENGINEERS. *Life of Concrete Domestic Sewers.* Dom. Eng., v. 96 (1921), p. 559-562.

Describes failures in Pasadena concrete sewers. Table containing information concerning concrete sewers in 44 American and Canadian cities. Illustrated.

ANDERSON, A. O. See II.

ANDERSON, G. G. See II.

- ASCH, W. and D. *Action of Acids and Alkali on Cement. Portland Cements and Sea Water. "Silicates in Chemistry and Commerce."* (English ed., 1914), p. 189-198.
Highly technical study of chemical reactions.
- BACH, H. See HELBING, H., and H. BACH, IV.
- BARNETT, M. R. *Injury of Concrete by Water.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 168 (1906-7), p. 153-180. Abs. Eng. Rec., v. 54 (1906), p. 658.
Discusses the deterioration of an English aqueduct of limestone concrete and the repair of the same. Illustrated.
- BARR, W. M. and R. E. BUCHANAN. *Production of Excessive Hydrogen Sulphide in Sewage Disposal Plants and Consequent Disintegration of the Concrete.* Iowa State College Bul. No. 26 (1912), 16 p. Exc., Eng. N., v. 68 (1912), p. 1095. Exc., Eng. Rec., v. 66 (1912), p. 639. Abs., Eng. Rec., v. 63 (1911), p. 418. Abs., Chem. Abs., v. 6 (1912), p. 1483. Abs., Eng. & Contr., v. 38 (1912), p. 604-606, 590.
Describes investigation at four public institutions in Iowa, and conditions found. Discusses cause and effects of chemical action. Illustrations and tabular chemical data.
- BARTH, F. *Corroded Cement Tubes.* Stadt. Tiefb. v. 3, p. 43-47. Was. u. Abw., v. 5, p. 444. Abs., Chem. Abs., v. 6 (1912), p. 2831. Ton. Zeit., v. 36, p. 1081-1082. Abs., Chem. Abs., v. 6 (1912), p. 2988.
Chemical study of disintegrated cement sewer carrying waste from calcium chloride factory.
- BERGER, E. H. *Acid-proof Coatings for Concrete Surfaces.* Concrete, v. 16 (1920), p. 267-269.
Discusses use of bituminous paints, enamels, and mastics.
- BISHOP, W. *Cement Water Mains at Rahway, N. J.* A. W. W. A. Proc. (1910), p. 217-219.
Describes cement water mains in use for 38 years.
- BLEASE. *Effect of Calcium Chloride and Magnesium Chloride on Portland Cement.* Ton. Zeit. (1906), p. 1734.
- BLEININGER, A. V. See II.
- BLOUNT, B. See III.
- BRARD (later modified by D'HERICART and THURY). *Test With Sodium Sulphate.* Annales de Chimie et de Physique, v. 38 (1828), p. 16.
- BRODE, W. M., & Co. *Destructive Action of Butter Oil on Concrete.* Eng. N., v. 67 (1912), p. 257.
Disintegration of concrete in butter factory.
- BROOKS. *Effect of Sewer Gas on Concrete in a Chicago Sewer.* Eng. N., v. 76 (1916), p. 486-488, 511.
Discusses nature and causes of disintegration. Chemical data. Illustrated.
- BUCHANAN, R. E. See BARR, W. M., and R. E. BUCHANAN, IV.
- BURCHARD. *Effect of CaCl_2 on Portland Cement.* Mitt. Kgl. Matpr., v. 28, p. 338-343.
- CABOLET. *Swelling of Portland Cement.* Ton. Zeit., v. 32 (1908), p. 1019.
- CANDLOT. *Ciments et Chaux Hydrauliques.* Paris (1891), p. 257.
Chemical processes of decomposition.
- CARPENTER, R. C. *Materials Which Retard Activity of Portland Cement.* Cement, v. 8 (1907), p. 21-27.
Tests on cement containing various amounts of gypsum and calcium chloride. Tabular data of results.
- CHAMBERS, S. H. *Effect of Sewage and Sewage Gases on Portland Cement Concrete.* Conc. & Const. Eng., v. 5 (1910), p. 348-351. Surveyor, v. 37, p. 647, and suppl. Apr. 29, 1910. Abs., Chem. Abs., v. 4 (1910), p. 2174. Abs., Eng. Rec., v. 61 (1910), p. 633. Abs., Eng. & Contr., v. 33 (1910), p. 470. Abs., Eng. & Contr., v. 38 (1910), p. 590.
Describes action of domestic sewage on concrete containers. Results and conclusions of inspection and tests of affected concrete. Tabular data. Discussion by various engineers.
- COBB, J. W. *Disintegration by Crystallization and Freezing.* Am. Cer. Soc. Trans., v. 11 (1909), p. 65-69.
Discusses "force of crystallization" as distinct from simple expansion. Discussions. Illustrated.
- CREIGHTON, H. J. M. *Deteriorating Action of Salt and Brine on Reinforced Concrete.* Franklin Inst. Jour., v. 184 (1917), p. 689-704. Abs., Chem. Abs., v. 12 (1918), p. 415. Abs., Eng. & Contr., v. 49 (1918), p. 400.
General discussion of causes and manner of attack. Electrolysis considered as cause. Illustrated.
- CURRAL, E. P. *Solubility of Cement.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 192 (1912-13), p. 299.
Discusses solvent action of water, salt solutions, and acids on fresh and set cement. Notes tests.
- DAY, W. H. See II.
- DEBRAY, P. See DURAND-CLAYE, L., and P. DEBRAY, IV.
- DEVAL. *Action of Sulphate of Lime upon Cements.* Soc. d'Encour. l'Ind. Nat. Bul. (July 31, 1901), p. 96. Abs., Inst. Civil Eng. (Lond.) Min. & Proc., v. 147 (1901-02), p. 491.
Discusses experimental investigation of the use of lime sulphate to determine the percentage of lime aluminate in Portland cement.
- . *Decomposition of Cements by Calcium Sulphate.* Soc. d'Encour. l'Ind. Nat. Bul. (1901), p. 785.

- DEVAL. *Disintegration of Mortars by Filtration*. Soc. d'Encour. l'Ind. Nat. Bul. (1900), p. 269.
- . *Disintegration of Mortars in Saline Solutions*. Soc. d'Encour. l'Ind. Nat. Bul. (1900), p. 20, 30, 669.
- . *Preparation of Composition of Calcium Sulpho-Aluminate*. Ton. Zeit. v. 26, p. 1081.
- D'HERICART. See BRARD, modified by D'HERICART and THURY, IV.
- DITTOE, W. H. *Effect of Sewage on Concrete*. Eng. Rec., v. 62 (1910), p. 140.
Describes disintegration in concrete septic tank at Amherst, Ohio.
- DOLZYNSKI, *Effect of Chlorides upon Portland Cement*. Ton. Zeit., (1892), p. 64.
- DOROZUISKI. *Double Decomposition with Artificial Zeolites*. Zhurnal Russkago fiziko-khimicheskago obshchestva (Journal of the Russian Physico-Chemical Society), (1910), p. 435.
- D'ROHAN. See II and III.
- DUMAS, A. *Paris Sewer under Pressure*. Genie Civil, v. 28, p. 277.
- DUNN, W. *Effect of Sewage Gases on Concrete Work*. Cem. & Eng. N., v. 22 (1910), p. 434-435. Abs., Chem. Abs., v. 5 (1911), p. 182.
Observations and laboratory tests show damage. Action discussed.
- DURAND-CLAYE, L., and P. DEBRAY. *Failures of Various Works Owing to the Employment of Magnesian Cements*. Ann. des P. et Chs., 6th ser., v. 11 (1885), p. 845. Abs., Inst. Civil Eng. (Lond.), Min. & Proc., v. 87 (1886), p. 462.
Swelling and cracking in concrete bridges laid to high magnesia content of cement. Tests upholding this theory.
- DYCKERHOFF, R. See III and VI.
- EDDY. See METCALF and EDDY, IV.
- ELLIOTT, G. R. B. *Effect of Organic Decomposition Products from High Vegetable Content Soils upon Concrete Drainage*. Jour. Ag. Research, v. 24 (1923), p. 471-500 plus plates.
- ENDELL, K. *New Researches on Cement*. Zeit. Ang. Chem., v. 31 (1918), I., p. 233-234, 238-240. Soc. Chem. Ind. Jour., v. 38 (1919), p. 76-A. Abs., Chem. Abs., v. 13 (1919), p. 1005-1006.
Review of 10 years' German literature on cement and effects of chemical agents.
- ERDMENGER, A. V. *Effect of Various Salts on the Behavior of Portland Cements*. Ohio Geological Survey Bul. No. 3, 4th ser. (1904), p. 364.
Table showing effects of various percentages of salts on time of setting and tensile strength.
- ERDMENGER, L. *Experiments on the Action of Magnesia in Portland Cement*. Inst. Civil Eng. (Lond.), Min. & Proc., v. 114 (1892-93), p. 401.
Results of experiments on neat and mortar specimens to determine effect of magnesia in cement, both as an added constituent and as replacing part of the lime.
- EUDRIS. *Cause and Prevention of the Destruction of Egg-Shaped Concrete Sewers*. Gesundheits-Ingenieur, v. 36 (1913), p. 513-522.
- FERET. *Mechanical Processes of Disintegration*. Ciment (1896), p. 212. Revue du Genie Militaire, July-Aug., 1891, p. 495. Baumaterialienkund (1896), p. 139.
- GADD, W. L. See V.
- GAINES, R. H. See V.
- GARTLAND, J. *Does Salt Water Increase the strength of Cement Mortar?* Eng. N., v. 24 (1890), p. 542.
Tests covering 14 months on 2,531 briquettes to determine the effect of salt water in mixing mortars.
- GARY, M. *Enemies of Cements*. Mitt. Kgl. Matpr., v. 37 (1919), p. 12-18. Abs., Chem. Abs., v. 14 (1920), p. 2541.
Discusses internal and external chemical agencies; their causes and effects.
- GERMAN CONCRETE ASSOCIATION. *Action of Oils Upon Concrete*. Can. Eng., v. 42 (1922), p. 115.
Requirements of linings for concrete oil tanks. Notes two methods of treating concrete surfaces to render oil-proof.
- GOLDRICH. *Effect of Sulphur Contained in Portland and Slag Cements*. Chem. Zeit., v. 34, p. 419.
- GOTTSCHALK. *Concrete with Mineral Oil*. Bet. u. Eis., v. 12, p. 247.
- GREENMAN, R. S. *Examination of Concrete Failures for Their Determining Causes*. A. S. T. M. Proc., v. 14 (1914), p. 322-338.
Discussion of ingredients, workmanship, and external forces as factors in concrete failures. Discussions by various engineers.
- HACRUNCHILD. *Effect of Bleaching Powder on Cement*. Ton. Zeit., v. 25, p. 1771.
- HART. *Formation of Salt Solutions in the Setting of Portland Cement*. Ton. Zeit., v. 32, p. 754.
- HARTLEB, R. See STUTZER, A., and R. HARTLEB, IV.
- HEISE, C. A. *Deteriorating Effects of Acids (and Salts) upon Concrete*. Concrete, v. 17 (1920), p. 169. Abs. Chem. Abs., v. 15 (1921), p. 299. Abs. Eng. & Contr., v. 54 (1920), p. 620.
Discusses relative effects of acids and soluble salts.

- HEISE, C. A. *Effect of Ammonia Water on Concrete*. Concrete, v. 18 (1921), p. 249.
Reinforced concrete tank withstands action of ammonia water for 15 years.
- HELBING, H., and H. BACH. *Destruction of Concrete Structures by Leakage Water*. Zentralblatt der Bauverwaltung, v. 39 (1919), No. 87, p. 520-522.
- HERING, R. *Cement Sewer Pipe*. Cem. Age, v. 4 (1907), p. 238-240. Abs., Chem. Abs., v. 1 (1907), p. 1463.
Enumerates advantages of cement over vitrified clay.
- HEUBLEIN, O. See TILLMANS, J., and O. HEUBLEIN, IV.
- HEUCHLING, F. G. See WESTON, R. S., and F. G. HEUCHLING, IV.
- HEYER. *Destruction of Concrete by Hydron Sulfide*. Chem.-Zeit., v. 40 (1916), p. 102.
- HILDRETH, K. E. *Acid-proofing Concrete*. Concrete, v. 12 (1918), p. 205.
Brief discussion of the use of pitch, gilsonite, or uinitate (an asphalt), and minubrite (a commercial asphalt product) as a protective covering for concrete exposed to acids.
- HOLLEY, A. E., and H. W. WEBB. *Acid-resisting Cement*. Chem. Abs., v. 13 (1919), p. 504.
Composition of two acid-resisting cements patented in United States of America.
- HOOL, G. A., and N. C. JOHNSON. See III.
- HOUGH, N. G. See V.
- HOWAT, W. L. *Effect of Saturated Sodium Sulphate Solution on Structures of Clay Burned to Different Temperatures*. Am. Cer. Soc. Trans., v. 17 (1915), p. 249-252.
Discusses two tests for resistance of brick, stone, etc., to weathering: the water-absorption-freezing-thawing test and the Brard or sodium-sulphate test. Results of tests by latter. Tabular data. Illustrated. Discussions.
- HUMPHREY, R. L. See III.
- HUMPHREY, R. L., and J. S. SEWELL. See III.
- JACOBSON, M., and J. G. DE KERAVENT. *Action of Chemical Agents on Concrete*. L'Industrie Chimique (1920), p. 391. Abs., Chem. & Met. Eng., v. 23 (1920), p. 1269.
Action of acids, salts, tar derivatives, fertilizers and oils.
- JOHNSON, N. C. See HOOL, G. A., and N. C. JOHNSON, III.
- KARL. *Effect of Sewage on Concrete*. Eng. Rec., v. 62 (1910), p. 28. Abs., Chem. Abs., v. 5 (1911), p. 367.
Nontechnical discussion of concrete exposed to sea water and sewage.
- KAUFMAN, G. *Advantages and Durability of Cement Sewer Pipes*. N. A. Cem. Users Proc., v. 8 (1912), p. 720-726.
Discusses manufacture and use.
- KENNEDY, G. G. *Action of Chemicals on Concrete*. Eng. Rec., 65 (1912), p. 326. Abs., Chem. Abs., v. 6 (1912), p. 1511.
Granolithic finish and bitumen paint as protection against hypochlorite of lime.
- KERAVENT, J. G. DE. See JACOBSON, M., and J. G. DE KERAVENT, IV.
- KLEINLOGEL, H. *Acid-proof Cements*. Chem.-Zeit., v. 45 (1921), p. 432-433.
Satisfactory results secured from tests with cement to be used in concrete containers for different kinds of acids.
- KLINKENBERG. *Formation of Calcium Sulpho-Aluminates*. Dinglers Polytech. Jour. (1894), p. 89, 114, 137, 163.
- KUHL, H. *Swelling Theory of Portland Cement*. Ton. Zeit., v. 33, p. 556.
See also ROHLAND, P., and H. KUHL, IV.
- LECHARTIER, G. *Influence of Magnesia on Portland Cement*. Comptes Rendus de l'Academie des Science, v. 102 (1886), p. 1223. Abs., Inst. Civil Eng. (Lond.), Min. & Proc., v. 88 (1886-87), p. 460.
Conclusions after eight years' observation of concrete failures claimed due to free magnesia in cement.
- LESLEY, R. W. *Action of Acid on Cement Pipe*. Cem. Age, v. 4 (1907), p. 241. Abs., Chem. Abs., v. 1 (1907), p. 1464.
Notes cases of resistance to acids in sewers.
- MACHARGE, W. S., and W. S. SHIELDS. *Action of Septic Sewage on Concrete*. Eng. Rec., v. 57 (1908), p. 652. Abs., Chem. Abs., v. 2 (1908), p. 2144
Describes concrete failures due to sewage.
- MARKUS, O. *Salt Water and Concrete Conduits*. Ton. Zeit., v. 36, p. 673. Abs., Chem. Abs., v. 6 (1912), p. 1974.
Tests show that concrete gauged with salt water resists action of salt water.
- METCALF and EDDY. *Sewer Gas and Concrete*. Eng. Rec., v. 64 (1911), p. 408. Abs., Chem. Abs., v. 5 (1911), p. 3899.
Concerns action of sewage admixed with salt water in forming hydrogen sulphide.
- MEZGER, ROBERT. *Destructive Action of Gas Water on Concrete*. Bauingenieur, v. 3 (1922), p. 408-412.
Results of experiences in gas works of Stuttgart, Germany. Measures for protecting concrete.
- MICHAELIS, W. *Der Cement-Bacillus*. Berlin (1892).
- MITCHELL, P. *Action of Salt Upon Cement*. Cem. Age, v. 10 (1910), p. 270.
Denies injury from salt in mixing water.
- MONTEMARTINE. *Action of CO₂ and H₂O on Cements*. L'Industria Chimica, v. 7 (1907), p. 321.

- MUTH. *Decomposition of Portland Cement*. Ton. Zeit., v. 33 (1909), p. 841.
- MUTH, W. *Decomposition of Cement by Water*. Chem. & Eng. N., v. 21 (1909), p. 417-418.
Discusses "swelling" of cement upon agitation in water. Describes experiments and progressive observations.
- NEUMAN. *Action of Acids on Concrete*. Ton. Zeit., v. 36, p. 601-604, 712. Abs., Chem. Abs., v. 6 (1912), p. 1832, 1974.
Discusses cases of concrete sewer and tunnel failures and causes and nature of disintegration of underground concrete. Preventative measures suggested.
- NEWHALL, C. A. *Disintegration of Concrete in Railway Tunnels*. Pacific N. W. Soc. Engineers, Oct.-Nov., 1916, 17 p.
- NEW YORK (CITY) BOARD OF WATER SUPPLY. See II.
- NITSCHE, H. *Barium Carbonate as a Protection Against Attack of Sulphate-Containing Solutions*. Zement (Feb. 15, 1923), p. 51. Chemisches Zentralblatt (1921), p. 593.
- OCHS, E. J. *Action of Sulfuric Acid on Concrete*. Concrete, v. 22 (1923), p. 56.
Brief account of investigation showing harmful effects of sulphuric acid.
- OLMSTEAD, F. H. and H. HAMLIN. *Converting Portions of the Los Angeles Outfall Sewer into a Septic Tank*. Eng. N., v. 44 (1900), p. 317-318. Eng. N., v. 41 (1899), p. 389-390. (Disintegration noted.)
Describes plans for altering outfall sewer at Los Angeles. Report on disintegration of brick and mortar portions.
- ORTON, E., Jr. and others. See II.
- PACINI, A. B. *Metamorphism of Portland Cement*. Annals New York Academy of Science, v. 22 (1912), p. 179-219.
Discusses processes involved in setting and hardening of cement and effects of various ingredients and treatments. Laboratory experiments and results. Tabular data.
- PAGE, L. W. See V.
- PARSON, H. DE B. *Influence of Sugar on Cements*. Eng. N., v. 18 (1887), p. 461.
Describes strength tests on mortar briquettes made with sugar admixtures. Tabular data.
- PETRY, W. *Effect of Acids and Salts on Concrete*. Bauingenieur, v. 1 (1921), No. 1, p. 12-14.
- PHILIPPI. *Solubility Tests in Lime-Silica Series*. Ton. Zeit., (1910), p. 1319.
- PLUMB, R. A. *Progress in Proofing Concrete Against Chemical Action*. Concrete, v. 8 (1908), no. 8, p. 37. Abs., Chem. Abs., v. 2 (1908), p. 2611.
Discusses acid action on concrete. Describes tests of protective coatings and results.
- POWERS, M. I., Jr. *Effect of Salt in Mixing Cement Mortars*. Eng. N., v. 26 (1891), p. 481.
Tests showing early gain in strength over fresh-water mortars.
- PULVER, H. E. *Effect of Salts on Strength of Concrete*. Wis. Eng., v. 18 (1913), p. 6-13. Eng. Rec., v. 68 (1913), p. 466. Conc. Cem. Age, v. 3 (1913), p. 256.
Results of laboratory strength tests on concrete cubes to which sodium chloride and calcium chloride were added in mixing water. Cured at high and low temperatures. Tabular and diagrammatic data.
- REYES, F. D. See WITT, J. C., and, F. D. REYES, IV.
- RICHARDSON, R. D. *Effect of Mine Water on Concrete*. Eng. Rec., v. 63 (1911), p. 75.
Tests on concrete in acid mine water near Scranton, Pa.
- RODT, V. *Behavior of Portland Cement in Different Salt Solutions*. Mitt. Kgl. Matpr., v. 33 (1915), p. 229-240. Soc. Chem. Ind. Jour., v. 35 (1916), p. 541. Chem. Abs., v. 10 (1916), p. 2135.
Discusses laboratory tests to determine the extraction of lime from mortar by various salt solutions.
- ROHLAND, P. *Action of Sulphur Compounds on Cement and Concrete*. Bet. u. Eis., v. 13 (1914), p. 241-242. Abs., Chem. Abs., v. 8 (1914), p. 3107.
Discusses injurious action in railway tunnels.
- . *Activity of Absorbed CO₂ ions*. Zeitschrift für Chemie und industrie der Kolloids, v. 5, p. 33.
- . *Behavior of Cement and Concrete in Contact with Salt Solutions and Acids*. Mitteilungen der Centralstelle zur Forderung der Deutschen Portland Cement Industrie, v. 3, p. 2-4. Abs., Chem. Abs., v. 8 (1914), p. 1493.
Discussion of chemical action of soil alkalies and acids on concrete.
- . *Causes of Efflorescence on Mortars*. Zeitschrift für Chemie und Industrie der Kolloids, (1910), p. 48.
- . *Decomposition of Portland Cements*. Zeitschrift für das Gesamte (Brauwesen), (1906), p. 704.
- . *Effect of Humus, Sulphur Compounds and Electric Currents on Concrete, Particularly Reinforced Concrete*. Stadt. Tiefb., v. 2, p. 105-06. Was. u. Abw., v. 4, p. 343. Abs., Chem. Abs., v. 6 (1912), p. 144.
Discusses action of these agents and protective coatings for concrete.
- . *Reinforced Concrete and Electric Current*. Stadt. Tiefb., v. 3, p. 1617. Was. u. Abw., v. 5, p. 504. Abs., Chem. Abs., v. 6 (1912), p. 3173.
Discusses action of electric current and electrolysis.

- ROHLAND, P. *Resistance of Reinforced Concrete Against Waters of Various Kinds*. Das Wasser (1912), p. 7-8. Was. u. Abw., v. 5, p. 505-506. Abs., Chem. Abs., v. 6 (1912), p. 3173.
Discusses protective coatings for reinforced concrete exposed to carbon dioxide, sulphur, and salt waters.
- ROHLAND, P., and H. KÜHL, *Preservation of Cement or Concrete in Railroad Tunnels*. Zeitschrift des Vereins Deutscher Eisenbahnverwaltung, December, 1912. Abs., Chem. Abs., v. 7 (1913), p. 2104.
Discusses action of smoke gases and the resistance of iron-ore cement concrete. Other preservatives suggested.
- ROSA, E. B., and others. *Electrolysis in Concrete*. U. S. Bur. Stand. Tech. Paper, No. 18 (1919), 2d ed., 140 p. Abs., Amer. Soc. of Refrigerating Eng. Jour., v. 2 (1916), No. 5, p. 25-30.
Describes laboratory and field tests and results. Thirty-two conclusions. Discusses dangers under practical conditions and protective measures. Tabular and diagrammatic data. Bibliography. Illustrated.
- SABIN. *Effect of Clay on Cement Mortars*. "Cement and Concrete" (1905 ed.), p. 253-258, 305-306.
Discussion of effects of various percentages of clay on tensile and compressive strength of cement mortar and concrete. Tabular results.
- SCHERER, R. W. *Cement Research in Germany*. Rock Products, v. 26 (Mar. 24, 1923), p. 21, 22.
Describes investigations to determine effects of marsh water on concrete.
- SCHIFFNER. *Effect of CO₂ on Cement*. Chem. Zeit. (1899), p. 107, 197. Ton. Zeit., v. 23, p. 909.
- SCHOTT. *Effect of Gypsum on Portland Cement*. Ton. Zeit. (1894), p. 819.
- SEWELL, J. S. See HUMPHREY, R. L., and J. S. SEWELL, III.
- SHAVER, A. C. *Life of Concrete When Used as Carrier of Domestic Sewage*. Sanitary & Heating Eng., v. 96 (1921), p. 189-192. Dom. Eng., v. 96 (1921), p. 559-562.
Committee report showing deterioration of concrete as affected by sewer gas and alkalies.
- SHERMAN, H. L. *Outfall Sewer of Poor Concrete Pipe Disintegrates*. Eng. N. Rec., v. 80 (1918), p. 525-526.
Describes disintegration of concrete sewer at Calexico, Calif. Illustrated.
- SHIELDS, W. S. See MACHARGE, W. S., and W. S. SHIELDS, IV.
- SOUTHGATE, W. W., and others. *Nashville Concrete Bridges Show Serious Deterioration*. Eng. N. Rec., v. 87 (1921), p. 934-938.
Describes corrosion of reinforcing and spalling of concrete in two bridges. Discusses limestone screenings in concrete and sulphur-laden fog as possible causes. Illustrated.
- SOUTHWICK, L. T. B., and G. A. WELLMAN. *Effect of Clay on Cement Mortar*. Eng. Rec., 63 (1911), p. 332.
Results of tensile tests on 1,060 mortar specimens containing clay. Tabular data.
- STEPHAN, E. *Destruction of Concrete by Sulphuretted-Hydrogen Gas*. Bet. u. Eis. (Berlin), v. 9 (1910), p. 22-24.
- STERN. *Physico-Chemical Methods of Investigating Cement*. Zentralblatt Hydraulische Zemente, v. 1 (1910), p. 167.
- STEWART, JOHN T. *Durability of Concrete Tile in Peat*. Am. Peat Soc. Jour., v. 15 (July, 1922), p. 26-32.
Description of tile lines at Grand Rapids and Coon Creek.
- STONE and WEBSTER, ABERTHAW CONSTRUCTION Co., and others. *Effect of Salt Solutions on the Set and Durability of Concrete*. Conc. Eng., v. 3 (1908), p. 358 (5 col.). Abs., Chem. Abs., v. 3 (1909), p. 479.
Discusses action of salt added to mixing water. Also action of salt solutions on set concrete.
- STUTZER. *Action of CO₂ Water Upon Portland Cement*. Zeit. Ang. Chem. (1896), p. 317.
- STUTZER, A., and R. HARTLEB. *Decomposition of Cement by Bacteria*. Zeit. Ang. Chem. (1899), p. 402. Abs., Inst. Civil Eng. (Lond.) Min. & Proc., v. 139 (1899-1900), p. 448.
Investigation of cement reservoir lining in Germany indicates corrosive action of carbon dioxide to be aided by nitrifying bacteria.
- TACKE, DR. BRUNO. *On the Effect of Peat Soil on Concrete*. Mitteilungen des Vereins zur Förderung der Moorkultur im Deutschen Reiche. Book 28, p. 234-240.
- THURY. See BRARD, modified by d'HERICART and THURY, IV.
- TILLMANS, J., and HEUBLEIN, O. *Action on Carbonate of Lime of Carbonic Acid Dissolved in Water*. Gesundheits-Ingenieur, v. 35 (1912), p. 669-677. Abs. Inst. Civil Eng. (Lond.) Min. & Proc., v. 191 (1912-13), p. 402-403.
Discusses solvent action on calcium carbonate and bicarbonate of carbon dioxide in solution and conditions which may prevent this action. Tabular data.
- TOCH, M. *Preservation of Concrete Structures*. Chem. Eng., v. 27 (1919), p. 69 (5 col.). Chem. & Met. Eng., v. 20 (1919), p. 222-223. Abs. Chem. Abs., v. 13 (1919), p. 1006, 2117.
Discusses concrete failures from contact with salt water and chemicals. Describes various protective methods.
- TURNEAURE, F. E. *Spalling of Reinforced Concrete in Moist Location*. Eng. N. Rec., v. 80 (1918), p. 46-47.
Describes failure of slabs in hydraulic laboratory, Madison, Wis. Illustrated.

VICAT, L. J. *Brard's Sodium Sulphate Test*. Treatise on mortars and cements (1818); English translation by J. T. Smith (1835), p. 216-217.

Describes use of sodium sulphate solution to simulate expansive action of frost in mortars.

WASON, L. C., and others. *Effect of Salt on Concrete Sidewalks*. Concrete, v. 11, No. 6 (1917), p. 186.

Three short discussions of effects of common salt on concrete sidewalks and floors.

WEBB, H. W. See HOLLEY, A. E., and H. W. WEBB, IV.

WELLMAN, G. A. See SOUTHWICK, L. T. B., and G. A. WELLMAN, IV.

WESTON, R. S., and F. G. HEUCHLING. *Effect of Sewage on Concrete*. Eng. Rec., v. 61 (1910), p. 714. Abs. Chem. Abs., v. 5 (1911), p. 367.

Two letters discussing action of sewage on concrete and citing cases of failure and immunity.

WHEAT, G. G. and A. G. *Life of Portland Cement*. Brick, v. 28 (1908), p. 85 (8½ col.). Disc., A. P. C. M. Bul. 19 (1908). Disc., Cem. Era, v. 6 (1908), p. 164-165.

Describes disintegration of concrete from weathering and sewer gases. Discusses failure of cement drain tile and causes. Illustrated.

WHITE. *Action of Acid, Alkali, and Fermenting Liquor on Cement*. Zeitschrift für das gesamte Brauwesen, v. 29, p. 704.

—. *Decomposition of Portland Cement by CaCl₂ and MgCl₂*. Ton. Zeit. (1906), p. 1734.

—. *Effect of Oil Upon Portland Cement*. Chem.-Zeit. (1892), p. 371.

WHITE, A. H. *Disintegration of Cement Floors and Sidewalks*. Cem. & Eng. N., v. 22 (1910), p. 525 (4¾ col.).

Discusses expansion and contraction in concrete surfaces due to alternate wetting and drying. Also effects of free lime and magnesia. Describes laboratory tests and results.

—. *Free Lime in Portland Cement*. Jour. Ind. & Eng. Chem., v. 1 (1909), p. 5-10.

Describes microscopic test for free lime in cement. Discusses causes and effects of its presence.

WITHEY, M. O. *Ten-Year Tests Showing the Effect of Age and Curing Conditions on Concrete; Results of Tests of Ten-Year-Old Specimens*. Wis. Eng. v. 25 (1920), p. 19. (5 col.). Abs., Eng. & Contr., v. 54 (1920), p. 519-520.

Tests made at Wisconsin University laboratories. Tabular and diagrammatic data.

WITT, J. C. See II.

WITT, J. C., and F. D. REYES. *Solubility of Portland Cement and Its Relation to Theories of Hydration*. Philippine Jour. Sci., v. 13-A (1918),

p. 147-161. Abs., Chem. Abs., v. 13 (1919), p. 895.

Laboratory tests of cement agitated in relatively large volumes of water. Conclusions as to solubility and hydration. Tabular data.

WOODWARD, S. M., and F. C. YOUNG. *Effect of Moisture on the Strength of Concrete*. Cem. & Eng. N., v. 25 (1913), p. 177.

Discusses expansion and contraction of concrete due to varying moisture content as an explanation of tile failures.

WORMER. *Changes in Strength of Portland Cement*. Cem. Age, v. 4 (1907), p. 254-256.

Tests (tension) on mortar made with various salt and acid admixtures. Tabular data of results.

WYRALL, C. DE. *Electrolytic Action on Unreinforced Concrete*. Eng. Rec., v. 66 (1912), p. 268.

Effect of electric current through concrete as observed in two cases.

YOUNG, F. C. See WOODWARD, S. M., and F. C. YOUNG, IV.

EDITORIALS, ANONYMOUS ARTICLES, ETC.:

Acid-Proof Paints for Cements. Chem. Eng., v. 7 (1908), p. 206. Abs., Chem. Abs., v. 2 (1908), p. 2308.

Two formulas.

Acid-Proofing and Hardening of Concrete. Chem. & Met. Eng., v. 23 (1920), p. 297.

A commercial product. Use and results described. Illustrated.

Acids, Oils, and Fats, Action of, on Concrete. Eng. N., v. 69 (1913), p. 504.

Discussion of paper by W. L. Gadd, before Concrete Institute of London.

Action of Oils on Concrete. Eng. & Contr. v. 59 (1923), p. 503. Bldg. & Eng. News, v. 23 (Mar. 10, 1923), p. 3.

Brief reference to report presented to American Concrete Institute.

Action of Some Liquids on Cement and Concrete. Cem. & Eng. N., v. 24 (1912), p. 27. Eng. N., v. 67 (1912), p. 989.

Tests on specimens in sugar solutions, glycerine, and ammonia.

Alkali from Plaster as a Danger to Concrete. Eng. N., v. 64 (1910), p. 375.

Earth containing old wall plaster rejected for fill over concrete.

Bituminous Acid-Proof Coatings for Acid-Proofing Concrete Surfaces. Chem. & Met. Eng., v. 23 (1920), p. 287 (5 col.).

Bureau of Standards recommendations. Specifications and list of manufacturers.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—Continued.

Commercial Liquids, Effect on Concrete. Concrete, v. 9 (1916), p. 11–12. Abs., Eng. Rec., v. 74 (1916), p. 470–471.

Results of tests to determine reciprocal effects of storing various liquids in concrete tanks, some of which were treated.

Concrete Destroyed in Vacuum in Calveras Dam Culvert. Eng. N. Rec., v. 84 (1920), p. 1197–1198.

Concrete of temporary intake eaten away by vacuum. Prevented in permanent structures by air vents. Short discussion, with cuts and drawings.

Concrete in Sewer Construction, the Experience of Eleven American Cities With. Eng. & Contr., v. 45 (1916), p. 137, 277.

Short letters from engineers.

Concrete Tile, How Have Behaved in Sewers and Drains. Concrete, v. 10 (1910), No. 5, p. 63–64.

General review of introduction, use, and results of concrete tile for sewers and drains.

Corrosion of Steel in Concrete. Cem. Age, v. 10 (1910), p. 379.

Experiments with grout and other coatings as preventatives.

Oil and Concrete. Ry. Eng, v. 39 (1918), p. 135–137.

General discussion of effects of various oils on concrete both as coatings and emulsified in fresh mix. Results and conclusions of various tests.

EDITORIALS, ANONYMOUS ARTICLES, ETC.—Continued.

Oil on Concrete, the Effect of. Can. Cem. & Conc. Rev., v. 2, p. 24. Abs., Chem. Abs., v. 3 (1909), p. 237.

Protection for Concrete in Tunnel Construction. Ton. Zeit., v. 36, p. 1301. Abs., Chem. Abs., v. 6 (1920), p. 3173.

Grout-coated concrete blocks as a tunnel lining.

Rusting of Steel in Concrete. Eng. Rec., v. 63 (1911), p. 364.

Conclusions of Concrete Inst. of Great Britain regarding preventing rusting of reinforcing.

Soaking Concrete in Magnesium Fluo-Silicate and Sodium Silicate. Concrete, v. 17 (1920), p. 28–29.

United States Bureau of Standards tests of compressive strength and absorption of concrete specimens cured in these solutions. Diagrammatic data.

Sodium Sulphide, Effect of, on Portland and Slag Cements. Chem. Zeit. (1907), p. 237.

Sugar, Effects on Concrete. Eng. N., v. 69 (1913), p. 126, 274, 478, 1079.

Letters concerning prevention of deteriorating action.

Sulphuric Acid and Carbonic Acid, Action on Concrete. Dingers Polytech. Jour. (1908), p. 494.

V. WATERPROOFING OF CONCRETE

VARIOUS METHODS AND THE EFFECTS OF THEIR USE

ABRAMS, D. A. *Effect of Hydrated Lime and Other Powdered Admixtures in Concrete.* Structural Matter. Research Lab., Lewis Inst. (Chicago), Bul. No. 8 (1920), 74 p. A. S. T. M. Proc., v. 20 (1920), part 2, p. 149–203. Concl. Eng. N. Rec., v. 85 (1920), p. 55–56. Concl. Munic. Eng., v. 59 (1920), p. 50. Concl. Concrete, v. 17 (1920), Mill Sect., p. 42. Disc. A. S. T. M. Proc., v. 20 (1920), p. 204–218. Disc. Eng. N. Rec., v. 85 (1920), p. 1295. Abs., Chem. Abs., v. 14 (1920), p. 2695.

A report covering six investigations, including about 20,000 tests, with appendix covering further tests on 1,720 specimens. Effects of different percentages of the admixtures on mortars and concretes of various proportions and cements. Full description of tests and results. Conclusions regarding the following: Effect of powdered admixtures on tensile, compressive, and bond strengths; wear, plasticity, and yield, with respect to consistency, age, and proportions of mortar and concrete and kind and percentage of admixture. Waterproofing effects not considered. Eighteen diagrams and 32 tables.

See also HART, L. H., and D. A. ABRAMS, V.

ALEXANDER, M. P. See III.

AMERICAN RAILWAY ENGINEERING ASSOCIATION. *Waterproofing Masonry.* A. Ry. E. & M. W. A. Bul., v. 15 (1914), No. 163, p. 516–561.

Full discussion of various methods of waterproofing concrete, including specifications and requirements for many compounds.

ANDREWS, E. S. *Some Methods of Securing Impermeability in Concrete.* Conc. & Const. Eng., v. 16 (1921), p. 369–374.

Classification of methods for securing impermeability.

BAKER, I. L., and B. L. DOWLING. *Waterproofing with Alum and Soap.* Conc. Eng., v. 5 (1910), p. 34–35. The Technograph, 1908–9. Abs., Chem. Abs., v. 4 (1910), p. 956.

Discusses their use and describes tests and results. Tabular data.

BATES, P. H. See WIG, R. J., and P. H. BATES, V.

BOINTRAGER. *Effect of Waterglass on Cement.* Ton. Zeit. (1901), p. 42.

BOORMAN, T. H. *Waterproofing: Various Applications and Comparative Cost.* Conc. Eng., v. 4 (1909), p. 8. Abs., Chem. Abs., v. 3 (1909), p. 700.

Describes various compounds and their use.

- BOWMAN, S.** *Permeability of Concrete.* Soc. Chem. Ind. Jour., v. 38 (1919), p. 325-R. (4 col.).
Outline for investigating comparative merits of waterproofing agents, their effects on chemical and physical properties of concrete, and economic aspects of use.
- BOYDEN, H. C.** See III.
- BURGESS, J. H.** *Waterproofing Concrete.* Commonwealth Engineer, v. 8 (1921), p. 248-250, 306-307.
Gives results of permeability tests.
- BURTON, W. A.** *Tests of the Impermeability of Reinforced Concrete Pipe.* Iowa State College Eng. Exper. Sta. Bul., v. 4 (1908), No. 3, p. 20-34. Abs., Eng. Rec., v. 63 (1911), p. 257. Abs., Chem. Abs., v. 5 (1911), p. 1674. Abs., Cem. & Eng. N., v. 23 (1911), p. 155-156. Abs., Chem. Abs., v. 6 (1912), p. 282.
Student thesis. Tests of impermeability under pressure on mortar pipes, using clay, alum, soap, and reground cement as waterproofings. Tabular data. Diagrams. Illustrated.
- CABOT, S.** *Waterproof Cement.* Chem. Abs., v. 13 (1919), p. 2118.
Notes United States patent on waterproofing paste.
- CHAPMAN, C. M.** *Tests of Materials for Waterproofing Concrete.* Eng. Rec., v. 66 (1912), p. 701-702.
Suggestions regarding the testing of waterproofing materials for concrete.
- *Waterproofing with Water.* Eng. Rec., v. 62 (1910), p. 767-768. Abs., Chem. Abs., v. 5 (1911), p. 3141.
Discusses tests by Westinghouse, Church, Kerr & Co. on waterproofing effect of varying amounts of water in mixing concrete. Diagrams.
- CHRISTIAN, H. L.** See SMITH, R. B., and H. L. CHRISTIAN, V.
- DAVIS, J. L.** *Impermeability Tests on Concrete.* Eng. N., v. 68 (1912), p. 866-869. Conc. & Const. Eng., v. 8 (1913), p. 112-118. Abs., Chem. Abs., v. 7 (1913), p. 237. Compare Gardner, Chem. Abs., v. 6 (1912), p. 282. Compare Bates and Wig, Chem. Abs., v. 6 (1912), p. 1350.
Permeability and strength tests of mortars with hydrated lime, puzzolan, and other powdered admixtures. Tabulated results.
- *Waterproofing Concrete Structures.* Cement, v. 8 (1908), p. 445 (14 col.). Abs., Sci. Am. S., v. 65 (1908), p. 343. Abs., Chem. Abs., v. 2 (1908), p. 2137.
Describes laboratory strength and permeability tests on mortars and concretes, waterproofed in various ways, including use of colloidal admixtures and puzzolan cement. Tabular data of results.
- DONCASTER, E. A.** *Super-Cement.* Can. Eng. Inst. Jour., v. 3 (1920), p. 480, extract from Lime and Cement, 2d ed. (London, 1920).
Results of tests on "super cement" (Portland cement ground with treated gypsum), showing strength and waterproof qualities.
- DOWLING, B. L.** See BAKER, I. L., and B. L. DOWLING, V.
- DYCKERHOFF, A.** See II.
- DYCKERHOFF, R.** See VI.
- ELECTRO-CHEMICAL SUPPLY AND ENGINEERING Co.** See VI.
- ELMS, J. W.** *Experiments on the Permeability of Cement Mortars to Water Under Pressure.* Eng. Rec., v. 54 (1906), p. 467-468. Abs., Chem. Abs., v. 1 (1907), p. 232.
Pressure permeability tests on mortar specimens of Portland and natural cement with various mixes and sands. Tabular data.
- FERET, R.** *L'Imperméabilisation des Mortiers et l'Huile Anthracénique.* Ann. des P. et Chs., July-August, 1916.
Waterproofing Mortars with Heavy Oil. Mitteilungen der Centralstelle zur Forderung der Deutschen Portland Cement Industrie, v. 3, p. 178-180. Abs., Chem. Abs., v. 8 (1914), p. 2237.
Results of tests with various oils.
- FERGUSON, L. R.** See TOCH BROS., R. J. WIG, and L. R. FERGUSON, III.
- FLINN, A. D.** *Aluminum Sulphate for Waterproofing Concrete.* Eng. Rec., v. 57 (1908), p. 820. Abs., Chem. Abs., v. 2 (1908), p. 2438.
Discusses impervious concrete.
- FOWLER, E. S.** See HUFFMAN, O. L., and E. S. FOWLER, V.
- FORTIER, S.** See II.
- FULLER, W. B., and S. E. THOMPSON.** *Permeability Tests.* A. S. C. E. Trans., v. 59 (1907), p. 127-137.
Discusses various factors in proportioning concrete which effect permeability. Describes tests. Tabular data.
- GADD, W. L.** *Effect of Acids and Oils on Concrete.* Engineering, v. 95 (1913), p. 20. Conc. & Const. Eng., v. 8, p. 124-130. Abs., Chem. Abs., v. 7 (1913), p. 1408.
Discusses tests of waterproofing effects of admixtures of fats and oils and resulting conclusions as to other effects on the concrete.
- *Waterproofing Concrete.* Cem. & Eng. N., v. 23 (1911), p. 161-162. Abs., Chem. Abs., v. 6 (1911), p. 281.
Recipes for various coatings, washes, and mixing compounds to render concrete impervious.
- GAINES, R. H.** *Permeability of Concrete Methods of Waterproofing.* A. S. C. E. Trans., v. 59 (1907), p. 159-169. Exc., Eng. N., v. 58 (1907), p. 344. Ex. Abs., Chem. Abs., v. 2 (1908), p. 311. Disc., Eng. N., v. 59 (1908), p. 176, 260. Disc., Eng. N., v. 58 (1907), p. 448. Disc., Chem. Abs., v. 1 (1907), p. 3047.
Discusses use of electrolytes in gauging concrete and addition of colloids as methods for waterproofing concrete. Theories of decomposition of cement.

- GRITTNER, A. *Waterproof Concrete*. Int. A. T. M. Proc., v. 2 (1912), No. 8, Paper 20. 6 p. Eng. & Contr., v. 38 (1912), p. 116-117. Abs., Chem. Abs., v. 6 (1912), p. 2831. Compare Schick, Chem. Abs., v. 5 (1911), p. 2926.
Describes laboratory tests and results of investigation of magnesia fluate and potash soap as waterproofer. Tabular data.
- HART, L. H., and D. A. ABRAMS. *Does Hydrated Lime Weaken Concrete*. Eng. N. Rec., v. 85 (1920), p. 1295-1297.
Adverse criticism of conclusions in report by D. A. Abrams, "Effects of Hydrated Lime and other Powdered Admixtures in Concrete," with reply by Prof. Abrams.
- HOFFMAN, R. *Watertight Concrete*. Bet. u. Eis., v. 16, p. 365. Abs., Chem. Abs., v. 7 (1913), p. 236.
Gives composition of concrete which proved water-tight. Compressive tests show no drop in strength due to use of soap.
- HORN, A. C. *Interesting Study of Modern Waterproofing*. Waterpf. & Firepf., v. 1 (1908), p. 8-9. Abs., Chem. Abs., v. 2 (1908), p. 2004.
What Waterproofing May Do for the Cement Industry. Waterpf. & Firepf., February and March, 1908.
- HOUGH, N. G. *Effect of Hydrated Lime on Essential Qualities of Concrete*. Balt. Eng. Club Jour., June, 1917.
See also III.
- HUFFMAN, O. L., and E. S. FOWLER. *Tests to Determine the Values of Clay and Reground Cement for Securing Impermeable Concrete*. Iowa State College Bul. No. 5. Cem. & Eng. N., v. 23 (1911), p. 133-135. Abs., Chem. Abs., v. 5 (1911), p. 1984.
Thirty, forty, and sixty day strength, absorption and permeability tests on mortars and concrete made with admixtures of clay and reground cement. Results, conclusions, and tabular data.
- HUMPHREY, R. L. See III.
- KAMMÜLLER. *Concrete and Mortar, Tests of Their Perviousness to Water*. Der Bauingenieur, v. 3 (1922), p. 710.
- KLEHE. *Water-Tight Concrete*. Ton. Zeit., v. 34, p. 201-202. Abs., Chem. Abs., v. 4 (1910), p. 1231.
Discusses permeability tests of mortar plates of Portland cement and mixtures of cement with quicklime and hydraulic lime.
- LARNED, E. S. *Effect of Clay in Sand for Cement Mortars*. Eng. N., v. 57 (1907), p. 620.
Six letters by engineers regarding use of clay in making concrete and mortar.
- LAWSON, T. R. *Tests of Waterproofing Compounds*. Eng. N., v. 68 (1912), p. 448-449. Abs., Chem. Abs., v. 6 (1912), p. 3321.
Tests of seven commercial waterproofing compounds for concrete. Tabulated data.
- LAZELL, E. W. *Waterproofing with Hydrated Lime*. Waterpf. & Firepf., v. 3 (1909), No. 3, p. 5 (5 col.). Abs., Chem. Abs., v. 3 (1909), p. 2214.
Describes strength and waterproofing tests and results. Quotes from other investigators.
- MCCULLOUGH, F. M. *Tests of Permeability of Concrete*. Wisconsin Univ. Bul. No. 336 (1909) (Eng. ser., v. 6, No. 1), 36 p. Abs., Cem. Age., v. 10 (1910), p. 143.
Tests on 14 commercial waterproofing compounds. Full description of materials, tests, and results. Diagrammatic and tabular data.
- MECKE, P. *Waterproofing of Concrete*. Cem. & Eng. N., v. 23 (1911), p. 320-321. Abs., Chem. Abs., v. 6 (1911), p. 281.
Theoretical consideration of permeability and its prevention.
- MORRISON, A. See SMART, B. J., and A. MORRISON. V.
- NAGY, B. *Hydrated Lime in Drain-tile*. Concrete, v. 11 (1917), p. 122.
Short nontechnical discussion of its effects on mixing, casting, density, strength and appearance of cement tile.
- NATIONAL LIME ASSOCIATION. See VI.
- NEW YORK (CITY) BOARD OF WATER SUPPLY. *Permeability of Concrete*. N. Y. (City) Water Supply Bd. An. Rpt., v. 4 (1909), p. 121. Abs., Chem. Abs., v. 5 (1911), p. 2541.
Tests show benefits of admixtures of fine material to cement and of puzzolan and sand cements.
- OLSON, H. M., and F. J. D. WESTELL. *Cements, Etc.* Chem. Abs., v. 13 (1919), p. 1629.
Describes British patent on cementitious materials, made waterproof by admixtures during manufacture.
- PAGE, L. W. *Oil-Mixed Portland Cement*. Office of Public Roads (U. S. D. A.) Bul., No. 46 (1912). Eng. Rec., v. 66 (1912), p. 240-242. A. S. C. E. Trans., v. 74 (1911), p. 225. Conc. & Const. Eng., v. 8 (1913), p. 619-623. Abs., Chem. Abs., v. 6 (1912), p. 144, 2988. Disc., A. S. C. E. Trans., v. 76 (1913), p. 1094.
Strength, permeability and other tests on mortar and concrete mixed with various oil admixtures. Illustrated.
- PLUMB, R. A. *Waterproofing Concrete*. Can. Cem. & Conc. Rev., v. 4, p. 91-94. Abs., Chem. Abs., v. 4 (1910), p. 1660.
- SANBORN, T. See TAYLOR, A., and T. SANBORN. V.
- SCHICK, E. *Experiment in Waterproofing Concrete*. Bet. u. Eis., v. 10 (1911), p. 15. Abs., Inst. Civil Eng. (Lond.) Min. & Proc., v. 184 (1910-11), p. 391.
Discusses successful waterproofing concrete silos near Budapest by use of soft soap in mixing water.

- SCOTT, JAMES. *How Concrete is Made Waterproof*. Contract Rec., v. 35 (1921), p. 198-199.
Analysis of microscopical actions and chemical modifications taking place on addition of "puddle" to concrete.
- SMART, B. J., and A. MORRISON. *Permeability of Concrete by Water*. Australian Mining Standard, Apr. 18, 1918. Commonwealth Engineer, May, 1918.
- SMITH, R. B., and H. L. CHRISTIAN. *Effect of Coloring and Waterproofing on the Strength and Permeability of Cement Blocks*. Iowa Sta. Bul., v. 4 (1908), No. 3, p. 8-19.
Student thesis. Strength and absorption tests on mortars to determine effects of alum, clay, two commercial waterproofing compounds, and a commercial coloring compound. Tabular data and diagrams.
- TAYLOR, A., and T. SANBORN. *Some Experiments with Mortars and Concrete Mixed with Asphaltic Oils*. A. S. C. E. Trans., v. 76 (1913), p. 1094-1102. Abs., Chem. Abs., v. 7 (1913), p. 1794.
Strength, permeability, and absorption tests on mortars and concretes mixed with admixtures of asphaltic oil. Tabular data. Discussions.
- TAYLOR, W. P. *Methods of Testing Cement for Waterproofing Properties*. Munic. Eng., v. 31 (1906), p. 312-314. Abs., Chem. Abs., v. 1 (1907), p. 94.
Describes efficient method of preparing and testing specimens. Illustrated. Tabulations.
- TEDESCO, N. *Waterproof Concrete*. Cement, v. 17, p. 189-190. Abs. Chem. Abs., v. 7 (1913), p. 237. Compare Wig and Bates, Chem. Abs., v. 6 (1912), p. 1350.
Discusses necessity for waterproofing. Aquabar (a mixture of menhaden oil and sodium silicate) as a waterproofer.
- THOMAS, E. *Colloidal Cement Waterproofing*. Cem. Age, v. 11 (1910), p. 158-159. Abs., Chem. Abs., v. 4 (1910), p. 2992.
Gelatinous precipitate from cement agitated in water used as waterproofer.
- THOMPSON, S. E. *Permeability Tests of Concrete with the Addition of Hydrated Lime*. A. S. T. M. Proc., v. 8 (1908), p. 500-513 (compare Ibid., v. 6, p. 371). Eng. Rec., v. 57 (1908), p. 806. Cem. Age, v. 7 (1908), p. 47. Abs., Chem. Abs., v. 2 (1908), p. 2438.
Pressure tests to determine effect of hydrated lime on permeability of concrete. Tabular data. Illustrated.
- THOMPSON, S. E. See FULLER, W. B., and S. E. THOMPSON. V.
- TOCH BROS., WIG, R. J. and L. R. FERGUSON. See III.
- WAGNER, S. T. *Coal Tar and Asphalt Products for Waterproofing*. A. S. T. M. Proc., v. 13 (1913), p. 955-958. Chem. Eng., v. 18, p. 224-225. Abs., Chem. Abs., v. 8 (1914), p. 2050.
Enumerates some of the properties necessary in use for floors and underground masonry and some investigations desirable. Discussions.
- WEIDERHOLD, H. and others. *Waterproofing Cement Mortars and Concretes*. N. A. Cem. Users Proc., v. 3 (1907), p. 228-269. Am. Contr., v. 28 (1907), No. 4, p. 39. Abs., Chem. Abs., v. 1 (1907), p. 9000.
Five papers discussing the merits of various methods of waterproofing including asphalt mastics, elastic membranes, dry and liquid compounds, and hydrocarbon paints. Each advances arguments favoring some proprietary product.
- WESTELL, F. J. D. See OLSEN, H. M., and F. J. D. WESTELL, V.
- WHITE, ALFRED H. *Integral Waterproofings for Concrete*. Industrial & Eng. Chem., v. 15 (1923), p. 150-153.
Effect of integral waterproofing on rate of water absorption. Gives results of tests.
- WIG, R. J. See TOCH BROS., R. J. WIG and L. R. FERGUSON, III.
- WIG, R. J. and P. H. BATES. *Tests of the Absorptive and Permeable Properties of Portland Cement Mortars and Cements*. U. S. Bur. Stand. Tech. Paper No. 3 (1911), 127 p. Abs., Eng. N., v. 67 (1912), p. 818; ed. com., p. 851. Abs., Chem. Abs., v. 6 (1912), p. 1350-1351.
Laboratory tests on mortars and concretes with and without various waterproofing preparations. Full description of materials, methods, and results. Tabulated and diagramed data. Illustrated.
- WITHEY, M. O. *Permeability Tests on Gravel Concrete*. W. Soc. Eng. Jour., v. 19 (1914), p. 814-851. Eng. Rec., v. 70 (1914), p. 355.
Describes rather elaborate permeability tests on concretes of various composition. Tabular and diagrammatic data. Results. Conclusions. Illustrated.
- EDITORIALS, ANONYMOUS ARTICLES, ETC.:
Concrete that is Waterproof. Farmers' Advocate (London, Ontario), v. 55 (1920), p. 450.
Concrete Waterproofing Materials, Test Results with. Eng. N., v. 73 (1915), p. 125-126.
Describes German tests of water-repellant cement, lime putty, and trass.
Hydrated Lime, Improving Concrete by the Use of. Munic. Eng., v. 49 (1915), p. 211-212.
General discussion of use and effects.
Impermeable Concrete. Cem. Era, v. 5 (1907), p. 335. Abs., Chem. Abs., v. 2 (1908), p. 582.
Discusses various methods of waterproofing and results of tests.
Impermeable Concrete for Marine Work, Notes on Methods for Se-curing. See III.

EDITORIALS, ANONYMOUS ARTICLES,
ETC.—Continued.

Impervious Concrete. Eng. Rec., v. 55 (1907), p. 398-399. Abs., Chem. Abs., v. 1 (1907), p. 1610.
Editorial discussion of effect of wetness of mix and surface treatment on impermeability.

Impervious Concrete, Experiments on. Eng. N., v. 68 (1912), p. 1061. Abs., Chem. Abs., v. 7 (1913), p. 544.

Neat cement paste coating as waterproofing.

Impregnated Concrete Pipes. See II.

Waterproof Cement Paint. Cem. & Eng. N., v. 34 (Nov., 1922), p. 18.

Brief account of paint which is said to be unaffected by lime and alkalies.

Waterproof Concrete. Chimiste, v. 2 (1911), p. 66-69.

EDITORIALS, ANONYMOUS ARTICLES,
ETC.—Continued.

Waterproof Concrete. Engineering v. 85 (1908), p. 590. Abs., Chem. Abs., v. 2 (1908), p. 2142.
Editorial discussion of production of imperious concrete through choice of materials and care in mixing.

Waterproofing Concrete Blocks, Effect of. Waterpf. & Firepf., v. 1, No. 10, p. 10. Abs., Chem. Abs., v. 2 (1908), p. 2004.

Waterproofing Materials. A. S. T. M. Proc., v. 13 (1913), p. 459-465. Eng. & Contr., v. 40 (1913), p. 59-60. Abs., Chem. Abs., v. 7 (1913), p. 3010. Jour. Ind. & Eng. Chem., v. 5 (1913), p. 1027.
Committee report. Conclusions regarding causes of permeability of concrete and the use of integral and surface waterproofing treatments.

VI. ALKALI-RESISTANT CONCRETE

SPECIAL INGREDIENTS AND METHODS FOR PRODUCING RESISTANCE TO ALKALI AND SEA WATER;
INCIDENTAL EFFECTS OF SAME

AMERICAN RAILWAY ENGINEERS' ASSOCIATION. *Prepare Specifications for Slag Aggregate.* A. Ry. E. A. Bul., v. 20 (1919), No. 215, p. 707, 712 (3½ col.).

Committee recommendations concerning physical and chemical requirements. Suggestions regarding moisture in curing concrete. Bibliography on sea water and concrete.

BAMBER, H. K. G. *Setting of Portland Cement.* Conc. & Const. Eng., v. 4 (1909), p. 193-199.

General discussion of the theories of setting, and the effects of various treatments and conditions. Special reference to addition of gypsum. Discussion by various engineers.

BARKER, R. *Essential Qualities and Application of Concrete to Timber Structures in Sea Water for the Purpose of Increasing their Permanency.* N. A. Cem. Users Proc., v. 6 (1910), p. 158-167.

Discusses "iron ore" and puzzolan-Portland cements as to resistance to sea water, and describes methods of covering wood piling with concrete. Discussions. Tabular data. Illustrated.

BATES, P. H. *Review of the Present Status of Iron Ore Cement.* N. A. Cem. Users Proc., v. 8 (1912), p. 566-77.

General discussion of current knowledge and investigations on value of low-alumina-high-iron cements. Tabular data.

BIED, I. *Electric Cement.* Travaux Publiques (1922), Nos. 158, 159.

BIED, JULES. *Alkali Resisting Cement.* Congres Scientifc de 1922, Section du Genie Civil.

— *Les Ciments a Haute Teneur en Alumine.* Soc. d'Encour. l'Ind. Nat. Bul., Jan., 1923.

See also III.

BLEINIGER, A. V. See II.

BOHME. *Influence of the Addition of Various Pulverized Substances to Cement.* Inst. Civil Eng. (Lond.) Min. & Proc., v. 84 (1885-86), p. 454.

Abstract of report on results of extensive tests.

BROWN, H. P. *Marine or Iron Ore Cements.* N. A. Cem. Users Proc., v. 8 (1912), p. 578-596. Abs., Chem. Abs., v. 6 (1912), p. 1352.

Describes various tests on different cements, low in aluminum and high in iron, including accelerated sea-water tests. Tabular and diagrammatic data. Illustrated.

BURCHARTZ, H. *Behavior of Hydraulic Compounds in Sea Water.* Cem. & Eng. N., v. 22 (1910), p. 421-424. Eng. Rec., v. 62 (1910), p. 237.

Describes strength tests by Michaelis and Royal Testing Laboratory covering five years on puzzolan mortars in fresh and sea waters. Results and conclusions. Tabular data.

BURCHARTZ, H. and J. V. WROCHEM. *Investigation of the Action of Magnesium Sulphate Solution on Cement.* Mitt. Kgl. Matpr., v. 35, p. 206-213. Chemisches Zentralblatt Jahrg. 89 (1918), 2, p. 156. Abs. Chem. Abs., v. 15 (1920), p. 1745.

Results of chemical and physical tests on mortars of (a) Portland cement, (b) iron-ore cement, and (c) blast-furnace-slag cement exposed to salt water.

CANDLOT, E. *La Fabrication Du Ciment Fondu.* Chimie et Industrie, v. 7 (1922), p. 456-457.

See also III.

CAREY, A. See KYLE, J., and A. CAREY. VI.

CAY, W. D. See III.

- CHENOWETH, A. C. *Are Piles Spirally Wound Safe in Sea Water?* Eng. N. Rec., v. 80 (1918), p. 926.
Claims immunity from sea-water attack for "Chenoweth" reinforced piles.
- CHRISTIANI, RUD. *Ciment Fondu or Alcement*. (English translation by E. L. Heidenreich). Concrete, v. 22 (1923), p. 25-28.
- COIGNET. See III.
- COLLIER, B. C. *Use of Gunite in Preservation of Concrete Structures Affected by Sea-Water Action*. Can. Eng., v. 39 (1920), p. 457-459.
Describes successful repair of concrete structures damaged by sea water.
- CRUM, R. W. *Concrete Mixture and Mixing for Drain tile*. Concrete, v. 12 (1918), p. 85-86.
Discusses proportioning and mixing of concrete for tile. Conclusions from practical tests.
Using Iowa Gravel in Concrete. The Iowa Engineer, v. 22 (1921-22), No. 4, p. 1-3.
Discusses grading and proportioning of gravel aggregate in its relation to the strength of the resulting concrete. Tabular and diagrammatic data.
- DIECKMANN, G. P. *Some Experiments in Curing Tile*. Cem. & Eng. N., v. 24 (1912), p. 207.
Seven-day strength tests on tile cured by various methods. General description of tests and conclusions drawn.
- D'ROHAN, W. *Manufacture and Use of Slag Cement and Other Substitutes for Portland Cement*. Eng. & Contr., v. 34 (1910), p. 160-162 (Ed. comment, p. 157.)
Various recipes for making slag and puzzolan cements.
- DYCKERHOFF, R. and L. TETMAJOR. *Action of Certain Admixtures on Portland Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 81 (1884-85), p. 346-348, 349-351.
Results of tests of effects on strength of various pulverized admixtures. Critical discussion by Tetmajor.
- ELECTRO-CHEMICAL SUPPLY & ENGINEERING CO. *Acid-Proof Impermeable Cement*. Chem. Abs., v. 13 (1919), p. 1915.
Composition of a waterproof and acid-proof cement patented in France.
- FRAMM, F. *Alteration in chemical composition of cement Containing Different Amounts of Calcium Sulphate in Sea Water*. Chem. Zeit., v. 35, p. 256. Abs. Chem. Abs., v. 5 (1911), p. 2316.
Describes tests and results showing that SO₃ content is not injurious to sea-water concrete.
Influence of Gypsum on Portland Cement Concrete in Sea Water. Protokoll der Verhandlungen des Vereins Deutscher Portland-Zement-Fabri-kanten, Berlin, 1911, p. 226-243. Abs. Inst. Civil Eng. (Lond.) Min. & Proc., v. 187 (1911-12), p. 366.
Discusses strength and chemical tests on cements of high and low sulphuric acid content exposed to sea water. Results and conclusions. Tabular data.
- FRASER, O. *Effect of Confined and Compressed Air on Exposed Sea Walls*. Eng. N., v. 58 (1907), p. 589-590.
Discusses relative value of gravel and broken stone for sea-wall concrete, and air compression in pores as cause for disintegration.
- FREDE, GEORG W. *On the Behavior of Calcium Sulphate in Hydraulic Binders*. Zement, (Feb. 1, 1923), p. 35-36.
- GARY, M. *Report upon the Behavior of Hydraulic Mortars in Sea Water—III. Conclusions*. Mitt. Kgl. Matpr., v. 37 (1919), p. 132-170. Abs., Chem. Abs., v. 14 (1920), p. 2694. Concl., Conc. & Const. Eng., v. 14 (1919), p. 686.
Results of 15-year tests on mortars and concretes of high and low lime content and various mixtures of trass. Tabular data. Illustrated.
See also POULSEN, A., M. GARY, and C. SCHNEIDER, III.
- GASSIER. *Note on Comparative Mechanical Strengths and Stabilities in Sea Water of Crushed Sand Mortars and Sea-Sand Mortars*. Int. A. T. M. Prac., 6th Cong. (1912), Paper XVII-5, 9 p.
Description and conclusions of tests covering 15 years. Tabular data and diagrams.
- GOFFETTE, J. L. See III.
- GREEMAN, R. S. See IV.
- GRUN, R. *Influence of Blast Furnace Slag Gases (Sulphurous and Hydro-Sulphuric Acids) Steam and Heat on Reinforced Concrete*. Bet. u. Eis., v. 22 (1923), p. 267.
- HAMBLOCH, I. A. *Exposure of Reinforced Concrete Structures to Action of Sea Water*. de Ingenieur (The Hague), v. 22 (1914), p. 43-44. Abs., Inst. Civil Eng. (Lond.) Min. & Proc., v. 197 (1913-14), part 3.
Explains beneficial results of using puzzolan cements for sea-water structures.
- HERRMAN, P. *Dichtungs und Schutzmittel für Zementörtel und Beton*. Bet. u. Eis., Jan. 4, 1916.
Laboratory experiments on protective coatings for concrete.
- HIROI, I. *Long Time Tests of Portland Cement*. A. S. C. E. Trans., v. 76 (1913), p. 1027-1044.
Tests covering 14 years on cement and mortar briquettes in sea water. Tabular and diagrammatic data. Discussed by various engineers with accounts of other long time tests in air and water.
- Long-Time Tests of Portland Cement, Hydraulic Lime, and Volcanic Ashes*. Jour. College Engineering, Tokyo Imperial Univ., v. 10 (1920), p. 155-172.

HOLLEY, A. E., and H. W. WEBB. See IV.

JEANNERET, B. *Resistances Comparatives de L'Electric Ciment et du Ciment Portland A Divers Agents*. Bul. Tech. de la Suisse Romande (1922), p. 45.

JEWETT, J. Y. *Investigations of Modified Cements and of Alkali Action on Concrete of the United States Reclamation Service*. Eng. & Contr., v. 38 (1912), p. 265-266. Int. A. T. M. Proc., v. 2 (1912), No. 13, Paper XX₄ Eng. Mag., v. 44 (1912), p. 267-269. Discusses use of sand cement and the action of alkali on concrete.

JOINT COMMITTEE (ENGINEERING SOCIETIES). See III.

KASAI, S. *Alteration of Cement Mortar in Sea Water*. Ciment, v. 17, p. 21-25 Abs., Chem. Abs., v. 6 (1912), p. 1511. Tests of puzzolan cement mortars in sea water.

— *Chemical Alteration of Cement Mortars Containing Puzzolan in Sea Water*. Ciment, v. 17, p. 41-44. Abs., Chem. Abs., v. 6 (1912), p. 1511.

Chemical tests covering one year of fresh and cured parts in 3 per cent MgSO₄ solution. Discussion and conclusions.

KLAUDY, J. *Austrian Tests of Cement Mortars in Sea Water and Salts*. Zeitschrift des Oesterreiche Ingenieur und Architekten-Vereins, v. 61 (1909), p. 676 (8¼ col.) Abs., Cem. Age, v. 10 (1910), p. 40. Abs. Eng. N., v. 62 (1909), p. 362.

Chemical tests on mortar cubes of natural, Portland, slag, and puzzolanic cements exposed to various salt solutions and sea water. Illustrated.

KYLE, J., and A. CAREY. *Concrete in Relation to Marine Works*. Engineer, v. 83 (1897), p. 533, 534. Engineering, v. 63 (1897), p. 707, 833-834. Contract Journal, v. 36 (1897), p. 1030, 1031. Abs., Inst. Civil Eng. (Lond.) Min. & Proc., v. 130 (1896-97), p. 183.

Two papers with discussions and recommendations concerning composition and treatment of cement and aggregate, the making and placing of concrete, and general methods of procedure in laying concrete in sea-water works, both in situ and block construction.

LIPPINCOT, J. B. *Tufa Cement on Los Angeles Aqueduct*. A. S. C. E. Trans., v. 76 (1913), p. 520-546.

Discusses materials and manufacture of tufa cement. Comparative strength tests using tufa, sand, and German trass cements. Chemical analyses of various mixed cements. Conclusion and precautions regarding use. Tabular and diagrammatic data. Discussions. Illustrated.

LJAMIR. *Sea Water Resisting Cement*. Ton. Zeit. (1909), p. 197.

LORD, E. C. E. *Tar Impregnation for Concrete Drain tile*. Eng. N. Rec., v. 90 (1923), p. 828.

LOSSIER, HENRY. *Le Breton Arme et le "Ciment Fondu"*. Le Genie Civil, v. 80 (1922), p. 79-83.

LUIGGI, L. *Addition of Puzzolan to Reinforced Concrete in Sea Water*. Genie Civil, v. 58, p. 426. Abs., Chem. Abs., v. 5 (1911), p. 2167.

Rich mixtures or addition of puzzolan as protection. Tests noted.

— *Researches on Some Ancient Mortars*. No. 1 of No. 1 (new series). Abstracts of Inst. Civil Eng., London.

MARKUS, O. See IV.

MURALT, M. DE. See III.

NATIONAL LIME ASSOCIATION. *Effect of Lime in Preventing Reinforcing Corrosion*. Contract Rec., v. 34 (1920), p. 645.

Tests in air and water on concrete slabs reinforced with polished steel and made with admixtures of varying quantities of lime and gypsum.

NEWBERRY, S. B. *Cement for Sea Water Construction*. Cem. Age, v. 4 (1907), p. 38-41. Abs., Chem. Abs., v. 1 (1907), p. 772.

Discusses iron-ore cement and its use.

NITZSCHE, H. *Cement "Basillus"*. Bet. u. Eis. (Sept. 15, 1923), p. 232. See also II.

PAGON, W. W. *Report of Destructive Action of Sea Water on Concrete and Methods of Guarding Against it*. Balt. Eng. Club Jour., v. 5 (1915-16), Nos. 2, 3, 4, 6, 7, 8, 9. Exc., Eng. & Contr., v. 45 (1916), p. 469. Exc., Eng. Rec., v. 73 (1916), p. 702. Exc., Concrete, v. 9 (1916), p. 112. Exc., Engineering & Mining World, v. 102 (1916), p. 215.

Series of seven articles of from 3 to 7 pages each, comprising a collection of letters, papers, articles, and excerpts of same by various engineers and cement experts and containing opinions, observations, experiences, and results of tests by many authorities, as well as deductions, conclusions, and specific recommendations by the author regarding the composition and manufacture of sea-proof concrete.

POTTER, C. J. *Chemical Changes in Portland Cement Concrete, and the Action of Sea Water Thereon*. Soc. Chem. Ind. Jour., v. 28 (1909), p. 6 (8 col.) Ex. Abs., Chem. Abs., v. 3 (1909), p. 1581.

Laboratory and field tests in fresh and salt water showing superior resistance to salt solutions of mortars treated with carbon dioxide or made with "red cement." Discussion and tabular data.

POULSEN, A. *Diatom-Earth as Puzzolan for Cement*. Int. A. T. M. Proc., v. 2 (1912), No. 10, Paper No. 16, 11 p. Abs., Chem. Abs., v. 6 (1912), p. 2987.

Describes tests which show diatom-earth, properly used, to be beneficial to physical and chemical properties of sea-water concrete. Diagrammatic data.

- MAYNARD. *Puzzolan and Portland Cements in Sea Water*. Mitt. Kgl. Matpr. (1909), p. 239.
- . *Slag Cement and Sea Water*. Ton. Zeit., v. 30 (1906), p. 440.
- MEADE, R. K. See III.
- MICHAELIS, W. *Action of Sea Water upon Hydraulic Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 129 (1896-97), p. 325-333.
Technical chemical discussion of sea-water action and of tests made with briquettes of various composition in artificial sea water. Recommendations as to composition of cement and use of puzzolan material, etc., to obtain sea-resistant concrete. Tabular data.
- . *Puzzolan Lime Mortars in Sea Water*. Ton. Zeit., v. 33, p. 1908.
See also III.
- MICHAELIS, W., Jr. *Cement Which Is Proof against Sea Water*. Sci. Am. S., v. 64, p. 226-228. Eng. N., v. 58 (1907), p. 645-646.
Discusses limits of fineness for Portland cement and superiority of iron-ore cement in this respect and others.
- . *Decomposition of Concrete in Sea Water*. Balt. Eng. Club Jour., v. 5 (1915-16), no. 3, p. 4 (3½ col.).
Letter relating German experience with iron-ore cement as resistant to sea water.
- . *Iron-Ore Cement*. Cem. & Eng. N., v. 23 (1911), p. 112-113.
Describes tests covering eight years, comparing behavior of Portland and iron-ore cements in sea water. Results and conclusions.
- POULSEN, A., M. GARY, and C. SCHNEIDER. See III.
- RAVIER, L. *Protective Coatings for Sea-Water Concrete*. Eng. N. Rec., v. 86 (1921), p. 566.
Suggests neat cement and tar or paraffin coatings.
- REDGRAVE, G. R. *Manufacture and Properties of Slag-Cement*. Inst. Civil Eng. (Lond.) Min. & Proc., v. 105 (1890-91), p. 215-230.
Discusses manufacture, physical and chemical properties, with tabular data on chemical analyses and physical tests.
- ROHLAND, P. See II.
- SCHNEIDER, C. See GARY, M., and C. SCHNEIDER, III. POULSEN, A., M. GARY, and C. SCHNEIDER, III.
- SCHWARTZ. *Puzzolan Mortars in Sea Water*. Ton. Zeit., Oct. 4, 1909.
- SHAW, A. L. *Volcanic Tuff and Its Uses*. Concrete, v. 16 (1920), Mill Sect., p. 62-64.
Discusses the origin and nature of tuff trass and its use with lime and Portland cement to obtain sea-proof mortar and concrete. Diagrammatic data of a few strength and sea-water tests.
- SONNTAG, C. H. *Is Portland Cement Durable*. Rock Products, v. 7, No. 11 (1908), p. 26.
Cement as a construction material. Precautions in making and placing concrete. Leaching action of waters.
- SPACKMANN, H. S. *Cements Rich in Alumina; Their Development, Value, and Fabrication*. Zement (1922), No. 15, p. 185-187; No. 49, p. 524-525.
See also II.
- SPENGEL, ADOLF. *Fused Cement*. Ton. Zeit. (May 26, 1923), p. 325.
- TAFT, H. S. *Chemistry of Salt Water Cement*. Met. & Chem. Eng., v. 12 (1914), p. 26, 76 (9 col.). Abs., Chem. Abs., v. 8 (1914), p. 811, 1654.
Detailed discussion of properties of cement and aggregate and methods of mixing and placing necessary for sea-resistant concrete.
- . *Use of Concrete in Sea-Water Structures*. Int. Eng. Cong. Trans., v. 5 (1915), p. 338-363.
Discusses nature of action on concrete and the requirements of ingredients, mixing, placing, and curing for successful results. Notes cases of failure and success.
- TETMAJOR, L. See DYCKERHOFF, R., and L. TETMAJOR, VI.
- TROCHE, A. *Fused cement* (from a lecture by R. Christiani). Bet. u. Eis., v. 22 (1923), p. 271-275.
- WEBB, H. W. See HOLLEY, A. E., and H. W. WEBB, IV.
- WIG, R. J., and others. *Strength and Other properties of Concrete as Affected by Materials, and Methods of Preparation*. U. S. Bur. Stand. Tech. Paper No. 58 (1916), 170 p.
Detailed description of extensive tests on concrete and mortar specimens. Much tabular and diagrammatic data. Illustrated.
- WILLIAMS, A. E. *Iron Ore Cements*. N. A. Cem. Users' Proc., v. 8 (1912), p. 597-614. Abs., Chem. Abs., v. 6 (1912), p. 280.
Three-day accelerated tests on Portland and iron-ore cements in artificial sea water. Tabular data. Discussions by R. J. Wig and P. H. Bates
- WROCHEM, J. V. See BURCHARTZ, H., and J. V. WROCHEM, VI.
- EDITORIALS, ANONYMOUS ARTICLES, ETC.:
- Cement with High Content of Alumina, etc.* Le Genie Civil, v. 82 (1923), p. 5-8.
- Heath Clay for Cement in Sea Water*. Ingenioren (Copenhagen), (1906), p. 233-238, 239-245. Abs. Inst. Civil Eng. (Lond.) Min. & Proc., v. 168 (1906-7), p. 436-439.
Discusses chemical aspects of the use of Denmark "heath clay" in the manufacture of cement or as an admixture to Portland cement to produce sea-proof concrete. Results of field investigations.
- Impermeable Concrete for Marine Work. Notes on Methods for Securing*. See III.
- La Fabrication du Ciment Fondu*. Le Genie Civil, v. 80 (1922), p. 510.
- Water, Gas Tar, and Coal Tar, How to use on Concrete*. Irrigation Age, v. 31 (1916), p. 103.
Describes use on Boise, Idaho, project with suggestions.

